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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

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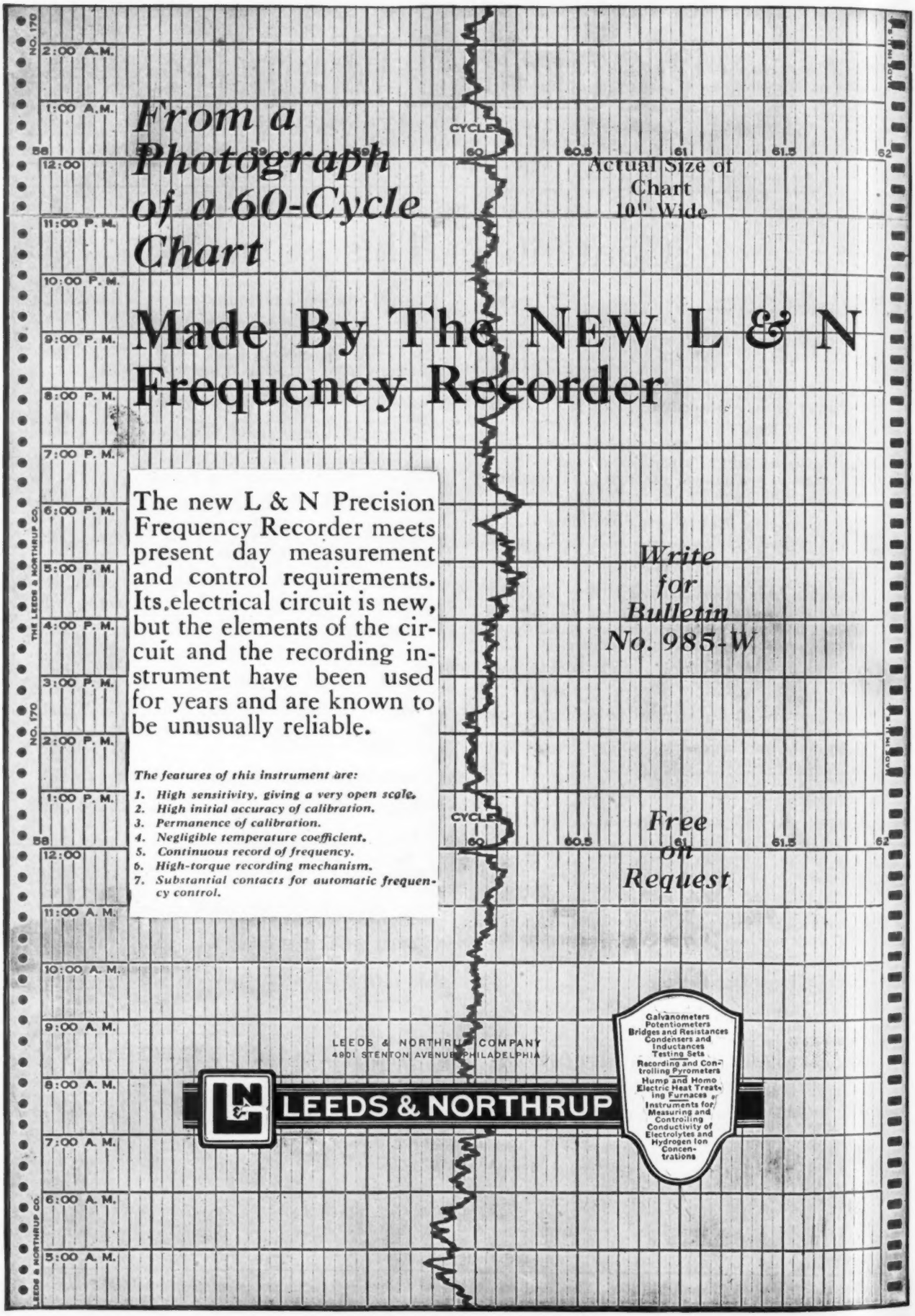
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Electrical World

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W. H. ONKEN, JR.
Editor

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Service Outages on Rural Lines

MANAGERS and engineers of enterprising electric public utility companies not only possess abundant faith in electricity, but show their faith by their works. That is to say, the service they offer is reliable and continuous and every effort is made to keep it so. Every worth-while public utility company has that kind of service in view, and while interruptions in circuits are apt to occur on any system, a diligent company is known by the infrequency of such interruptions. Obviously it is on the ends of systems that trouble is most likely to happen, so that rural service is not usually so reliable as suburban service and the latter does not compare with city service. But in no case ought there to be a very great difference in the quality of the service rendered. The industry should know but one standard and that invariably good. The aim is to give the smallest user as good a service as the largest.

Recently a manufacturer of incubators received a letter from a customer who apparently is anxious to buy one of his electric machines. The letter starts as follows: "Last spring I received your catalog advertising your new electric incubator. I decided it was just what I wanted and was about to order one when the power went off for fourteen hours. I have the city service, but am not on one of the main lines, so when there is trouble the other more important lines are repaired first, and they are in the habit of killing the line for several hours on Sunday to make repairs, especially during the spring." The manufacturer contends that interruption in the service is one of the greatest difficulties he meets with in selling his appliances and that one utility man suggested that the incubator be equipped with an oil lamp as auxiliary to the electric heating unit. While this is sage advice, what a reflection on the electric light and power industry, especially since the incubator in question will automatically care for an interruption of an hour or so! Only too well is it known that such service conditions exist; and we suggest that the industry give greater heed to the "tail-enders" and to the service outages on rural lines.

Friendship as an Adjunct to Good Will

EXECUTIVES of utilities which enjoy excellent public relations do not as a rule depend on publicity or advertising to air their problems or to tell how valuable the utility company is to the public. Neither do they rely implicitly on a public relations man or admonish their employees that they must treat the public courteously. These executives make friend-building a personal problem, and they do not forget to start with their employees. They lead by example and others voluntarily fall in line.

One executive has declared: "If any executive thinks he has too many other duties to allow him to devote his personal attention to friend-building, he had better delegate his other duties to a subordinate and make friend-building his major job." Financial, rate, personnel and other problems solve themselves when this attitude is adopted. If any executive cannot convince himself of the logic of this advice, the next best policy is to put friend-building in the hands of the commercial manager, in whose sphere most points of contact with the public usually fall.

Building friendship is not a separate function of any business; it is a vital part of every function of that business. It is vital from a purely dollar-and-cents business viewpoint with all altruism thrown to the winds. It builds business, as every chief executive knows, and if every employee could be convinced of these facts, attempts at good-will building throughout the industry would be more successful.

Impressions of the League Conference

A NEW page was certainly written into the history of organization in the electrical industry by the league conference at Association Island. There for the fifth time gathered the representatives of local electrical leagues. They came in greater number and from more communities than ever before, and the individual delegates were drawn from all branches of the industry. But the thought that impressed the observer particularly was that these men were all thinking and speaking, not with a class consciousness, but as league delegates, and the earnest purpose they expressed and the confidence they evinced in the importance of the league movement were in marked contrast with earlier conferences when everybody was feeling the way. Clearly the growth of the leagues both in number and in activities—there are now 140 leagues in all—is beginning to exert a very apparent influence in the industry, for men have come to recognize that it has brought a new and very fundamental element into the picture. There is increasing acceptance of the fact that in the electrical industry, too, leadership, after all, cannot be imposed by a national authority on uninterested workers in the field, but must win their acceptance and support if it is to prove a reality and not merely a form.

It was a most enjoyable convention, as all meetings are at this shrine of co-operation. The program was well balanced, interesting and constructive, but two features of the week overshadowed all others—the special meetings of "red seal" licensee leagues and the presentation of the League Council's market development program. Sixty-eight "red seal" licenses have been granted by the Society for Electrical Development, operative in 837 communities, and to about 1,700 houses certificates have been given. The movement is now getting well under way, and for probably the first time a group of local electrical men gathered together last week to discuss and decide on national policies which they have the power to apply and enforce. National leaders will, of course, continue to guide the

broad industry policies, but it would seem that a new spirit of democracy is now stirring among electrical men. Another point—both the "red seal" and the market development plans are the first commercial programs which promise continuity of policy and progress in the development of the electrical industry through a combination of "the nationalizing of local activity and the localizing of national effort," as S. L. Nicholson aptly expressed it before the conference.

The market development program will require careful study because it will become a broad and far-reaching instrument. It purposes to merge the local leagues with the Society for Electrical Development in a chapter relationship and to employ this organization for the co-ordinating of all product promotion programs as they are applied in the communities. It will entail an elaborate system of financing national and local needs, as is explained in detail on another page, but one that should greatly simplify the present burdensome and complicated practice. If it works at all, it will naturally and necessarily tie in the group of trade associations of the industry by offering them the most ready and convenient means for carrying out such national co-operative market-building programs as they may initiate.

How and how soon the leagues will act no man can say, but that they will accept the broad principle of the plan seems assured, so hearty was the indorsement at the conference by men well qualified to speak from both the national and local viewpoints. It will probably require much lucid interpretation and energetic selling to bring the leagues into line, but it will be worth it, and this process will inevitably round out and refine the plan.

Secrecy the Last Thing Needed

PROTESTERS against the establishment of regulating reservoirs on the Salmon River in New York State, in accordance with a law commonly believed to have been well conceived and drafted to aid the cause of flood prevention and the preservation of the public health, made last week a particular grievance of what they claimed to have been the secret way in which the promoters of the regulating district went about their work. The opponents of the plan asserted that the whole thing was a camouflaged scheme to develop water power from a mountain stream on state park land, and that it was intended to establish a precedent in accordance with which power could be generated on half a dozen other streams similarly situated, to the great injury of scenery and detriment of the people's rights.

Now, if the application and the date of the hearing—which, after all, did not escape the protesters' notice—were not sufficiently advertised, that was surely the fault of the law or the state officials rather than of the applicants for the establishment of the regulating district. Moreover, since two light and power company executives were the prominent spokesmen for the project before the Water Control Board when the hearing was held, and since they asserted that 12,000 horsepower was involved in addition to the storage features, just where the charge of attempted secrecy lies it is not easy to see. Whatever the truth in this regard may be, however, let it be conceded to the opponents of power development in state parks or elsewhere that secrecy has no justification in any plan involving the damming of running streams. The public, to whom the streams in most cases belong, has a right to know all the particulars of what it is proposed to do, so that every citizen may, if he sees fit, exert his right to protest and oppose. The poet has praised those who "do good by stealth and blush to find it fame," but his words do not apply to hydro-electric promoters. Fame better worth while for them will be founded on good done openly and proved good before it is done. We say this to appease the Adirondack protectors—not because we think the admonition needed.

Inducement Rates Should Be Simple

DOMESTIC business is exciting great attention in the electrical industry. It has two aspects which are widely different but equally important. One is concerned with selling the useful devices which will increase domestic consumption such as refrigerators, ranges and water heaters. The chief problems in this phase of the business are merchandising, and their proper solution requires that the industry develop high-grade commercial men.

The other aspect of domestic business is concerned with rate adjustments whereby existing rate structures can be changed without affecting revenues for present uses of electricity in the homes and yet provide customers with a rate which will induce the use of new devices. This is a problem in cost-accounting and public relations and is extremely difficult of solution. Energy production is cheap if only operating expenses are considered and it is taken for granted that fixed charges are paid by the present business. Therefore it is argued that all energy used beyond that now used by the average customer should be sold at a rate based on operating costs per unit of energy production. With this type of analysis any light and power company can put into operation a block rate which will prove a powerful inducement for the use of heavy-consumption devices in the home. A typical rate of this character would have, for example, a block of 30 kilowatt-hours per month to cover present use, another block added of, for example, 100 kilowatt-hours to cover refrigerators and flatirons, and all energy used in excess of 130 kilowatt-hours would be billed at an energy price based on operating costs. This last block might be billed at a very low rate and (based on this type of cost analysis) still be considered profitable.

But there are certain points which must be considered in such an analysis. One is that while fixed charges are largely collected in the first block on the basis of present use and present system capacity, the time will come soon when added system capacity will be needed because new devices have been added. These new devices do not operate at 100 per cent diversity factor or load factor, although they do add to these factors sufficiently to give definite economic advantages. But system demand will be increased and capacity will have to be provided. Under the conditions of some degree of saturation in the heavy-consumption residence business, it may well be argued that the fixed charges on the extra capacity should be collected from those responsible for this capacity. And it may be argued that it would be inequitable for low energy use to be considered as a basis of fixed-charge allocation.

Such elements as these, however, while essential in considering changes in business policy, should not be

permitted to obscure the picture. Increased use of energy is the greatest means known to reduce costs to consumers and to make profits for owners. There is a grand over-all economy to be secured, and this saving should go to both customers and owners if a proper rate structure is to be developed. Such a structure can be developed which will have the inducement element effectively introduced and without the use of any extreme or limit assumptions in its building.

Anticipating Maintenance Costs

AFTER troubles have culminated repairs become costly, but if troubles are caught in their early stages of development repairs are cheap. In a similar way complete failure of equipment affects service materially, while partial failure does this to a small degree. It is human nature to take action after rather than before an event; none the less, many interruptions to service would be avoided if the electrical industry would practice anticipatory maintenance more thoroughly.

Public utility companies should not follow the practice of installing an automatic substation, generating station, oil circuit breaker or cable and then expect to make repairs when failure occurs. That is a very expensive way to maintain a property and is the worst possible way to give reliable service. Proper inspection at frequent intervals will make for low repair costs and will practically eliminate service interruptions.

A bad contact on a relay, carbon on a breaker bushing and other minor things can be detected and eliminated at little or no cost if inspection is adequate. But left alone there develops a major failure which usually requires the installation of a complete new device and very often the replacement of other equipment adjacent to the apparatus that failed. Inspection will show stages of deterioration and enable repairs to be made without interrupting service. Even cable tests and inspections introduce this element, because a study of kenotron readings at intervals permits quite accurate predictions to be made of the time when the cables may fail. Experience on many properties shows that the way to keep down costs is to maintain the property in service, and this is best secured through the establishment of an anticipatory inspection system.

Electric Lighting Has No Saturation Point in Sight

THE central-station company has no cause to worry about a saturation point in lighting. Illumination intensities are very generally far below those desirable or economically possible. The greatest convenience is far from having been achieved. The use of light for esthetic and specific psychological effects has barely begun. Then, finally, luxurious lighting is still to be developed.

It has been shown that from a purely utilitarian viewpoint the homes in this country are about half lighted. That is, for convenient and useful lighting the homes need at least twice as many outlets as they now have, much more lighting equipment and more than twice the present connected lighting load in watts. After this level shall have been reached there will still remain the job of raising the standard of utilitarian lighting. All this does not include any decorative use of portable lamps, brackets and other equipment or any of the enormous possibilities of distribution and quality of light for esthetic effect.

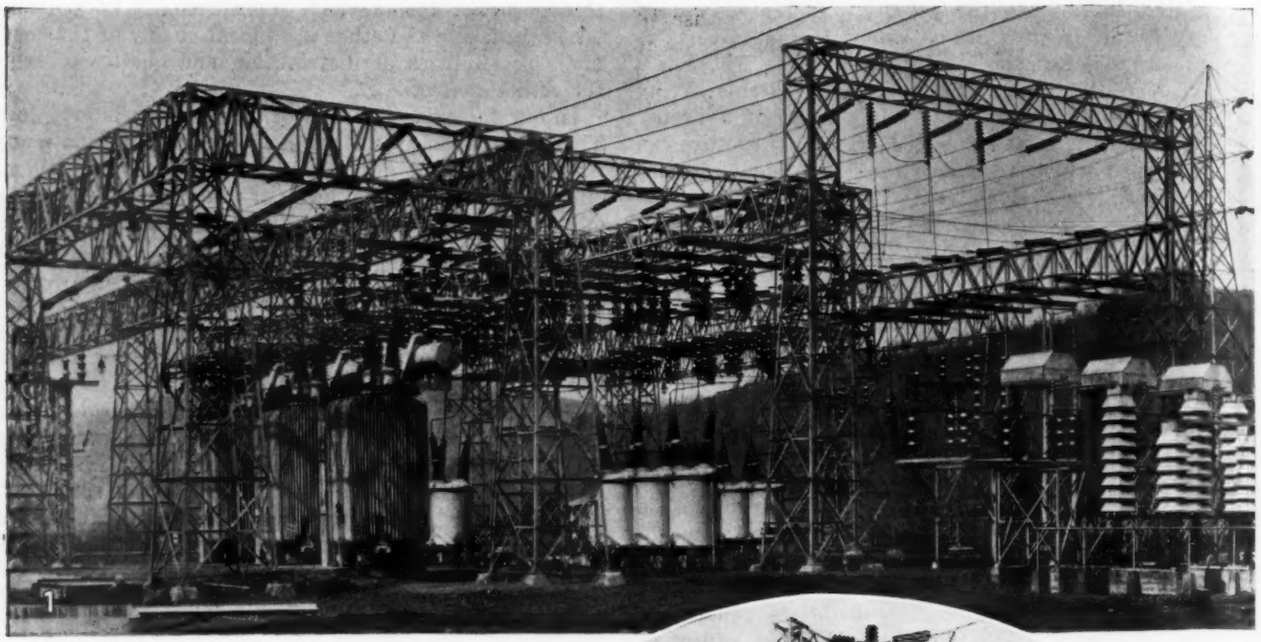
In our factories the level of illumination is very low. The best economy demands levels of illumination many times the present average. The same may be said of offices. In stores the level of illumination is being steadily increased, but the ultimate goal is not in sight. High-intensity illumination in show windows is far from what it could become, and the use of powerful artificial illumination for combating reflected images from windows has just begun. The tremendous potentialty of colored light and stage-lighting procedure are just beginning to dawn upon the display man. Cleverness in electrical advertising will keep that field growing for years to come. Electric lamps are now controlling traffic just as signals have guided railroad transportation, but only the surface of this field has been scratched. High-intensity street lighting is becoming recognized as one of the great aids in the traffic problem, and highway lighting is bound to expand enormously.

So it is in all fields. Artificial lighting is in its infancy. To be better than daylight is its goal, and the realization of that ambitious object will require enormous growth for generations.

Influence of Climate on Standardization

MANY reports of performances of electrical equipment which cannot be reconciled easily do not take into account the differences found in atmospheric conditions. In one locality busbars in service many years appear so bright that one would think they were polished. In another locality busbars become white or black or brown in a short while. Pole-type switches and disconnecting switches in one locality may operate satisfactorily, while in another place very frequent inspections and costly maintenance are required in order to keep the operating mechanisms in order and the contacts in shape. Similar experiences are reported with relays and other contact-making devices. Even carbon brushes are affected apparently, because brushes which in one location give satisfactory performance in another will "grow" and cause much trouble.

The atmosphere of most cities is dusty and dirty and contains dust particles of many kinds. The humidity and temperature of the air differ widely when measured in different cities on an annual average basis. A humid atmosphere with acid, alkaline or metallic dust particles of different varieties can readily start chemical actions or can serve as an electrolytic medium between electrodes. It is natural, therefore, to attribute many differences in equipment performance to local atmospheric effects, and this makes it necessary to consider carefully attempts to standardize apparatus and its service on a national basis. For indoor locations on many properties true economies in maintenance and better service would be obtained if the air were cleaned and conditioned. Outdoor equipments must be designed to meet the conservative average conditions, and properties with bad atmospheric conditions will find it economical and necessary to provide adequate inspection and maintenance if service with this equipment is to be reliable.

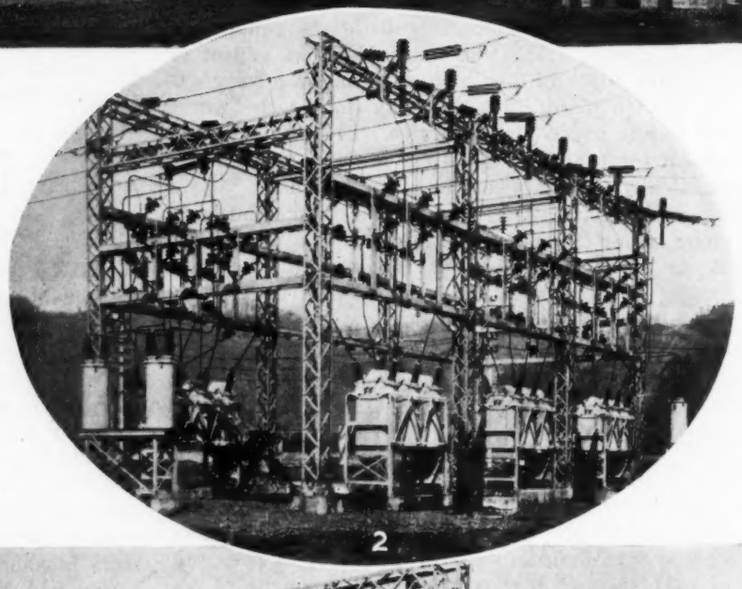


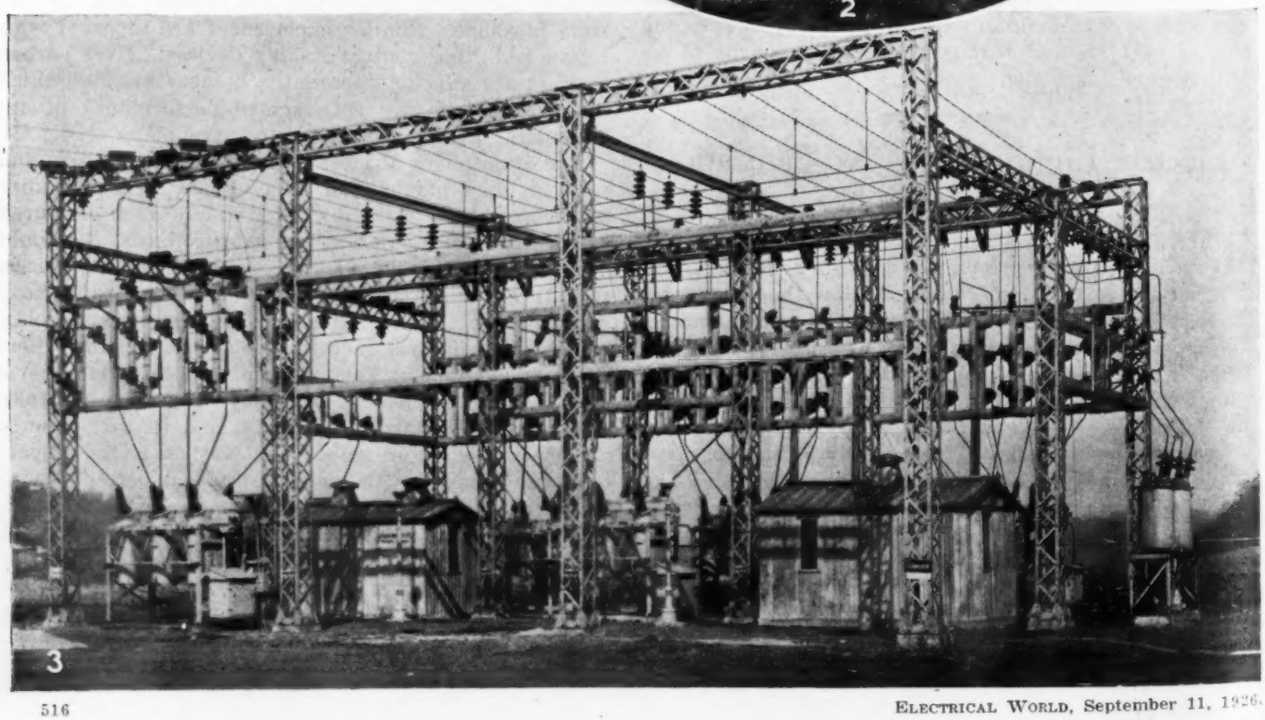
Nerve Centers of a Transmission System

THE American Gas & Electric Company operates an interconnected 132,000-volt trunk-line system extending from northern Indiana across Ohio and West Virginia into southwestern Virginia, Kentucky and Tennessee.

Power for this area is obtained from such well-known plants as Philo, Windsor, Twin Branch and Glen Lyn. The illustrations are of the 132/44-kv. St. Albans substation, near Charleston, W. Va., and the 44/23-kv. Capitol Hill substation at Charleston. Similarity in design will be noted, indicating standardization of equipment wherever feasible.

Fig. 1—132-kv. side of St. Albans substation.
Fig. 2—44-kv. side of St. Albans substation, from which the lines run about 12 miles to Charleston.
Fig. 3—The 44/23-kv. Capitol Hill receiving substation at Charleston.





Cable Installation
for Muscle Shoals Power House Described

By H. M. Friend
Formerly of Hugh L. Cooper & Company

Specifications for Cable Manufacture Rigidly Observed, with Strict Inspections During the Course of Manufacture—Additional Exacting Tests Applied in Installation at Plant—Arrangement of Circuits in Power House

ALL the wire and cable used in the power house at the Wilson Dam of the Muscle Shoals development were purchased under United States War Department contracts, with competitive bidding. Complete specifications were prepared covering the manufacture and testing of the wire and cable, and a cable inspector was stationed at the manufacturers' plants to watch materials, workmanship and processes and to make the physical and electrical tests on the completed cable.

Discussion of the cable may be divided into three parts: (1) The generator leads; (2) the control cable; (3) miscellaneous wire and cable.

The Generator Leads.—As this is one of the most vital points in the whole power house, the greatest care was taken to obtain an installation that would give the best possible service. Flame-proof braided cable supported on porcelain insulators was used in an isolated-phase cell structure for the run through the power house and up the river bank to the switchhouse. Braided cable instead of lead-covered cable was used for several reasons: First, less danger of an electrical breakdown in cable covered with a cotton braid and supported on insulators than with a lead-covered cable, the sheath being grounded; second, no troubles due to eddy current losses in the lead sheath; third, the cable being located in a perfectly dry place, a cotton braid covering gives sufficient protection; fourth, lower cost; fifth, lighter weight and easier to install.

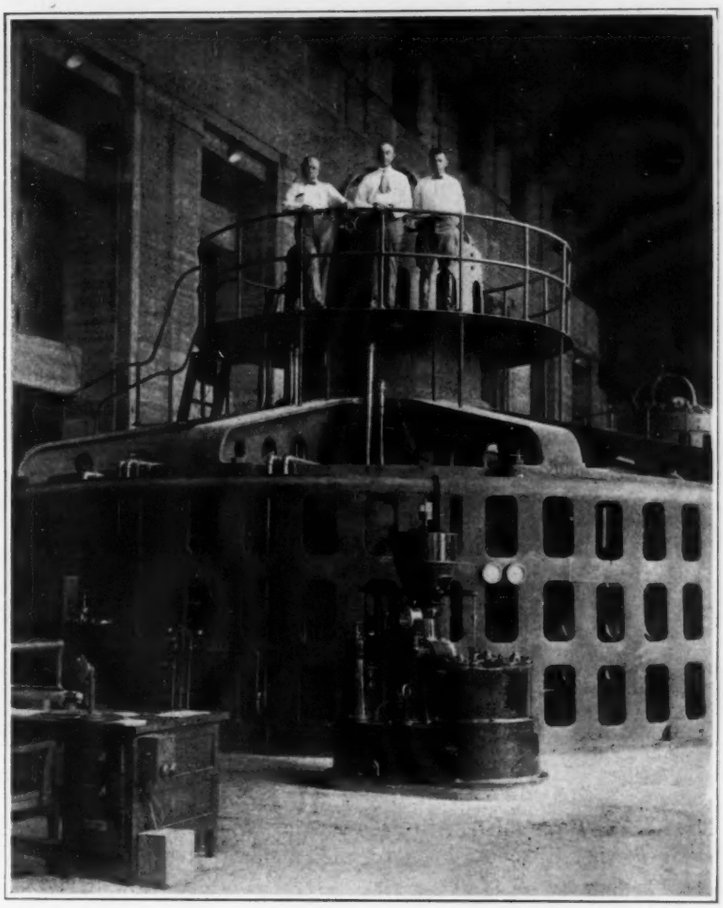


FIG. 1—ONE OF THE LARGE GENERATING UNITS
Standing on the platform are Colonel Cooper, General Taylor and Major Max Tyler, the resident engineer in charge.

The generator leads consist of four cables in parallel for each of the three phases. From the terminals of each machine they run downward, turn and then pass beneath the floor of the power house to its upstream wall through a short fiber conduit, in which they are centered by passing through porcelain "doughnut" insulators; the cable then runs through a concrete cell structure, the three phases of each generator being isolated, for the length of the power house and up the 131-ft. run of the generator lead tower to the switchhouse on top of the river bank. In this cell structure the cable is supported every 4 ft. on 15,000-volt porcelain insulators, the four cables for each phase being mounted on one insulator by means of a bronze clamp. The advantages of four cables in parallel for each phase instead of a single-conductor cable are: First, in case of failure of any one cable the three other cables could carry the load; second, greater flexibility and easier installation; third, greater heat-dissipating ability, hence a smaller cable, for the same load; fourth, less "skin effect."

For the first four 25,000-kva. generators the cables were 500,000 c.m. and for the four 32,500-kva. generators 650,000 c.m. The details of construction are as follows:

The conductor was made up of untinned copper, using

the standard concentric strand. Over the conductor was applied with an overlap a separator consisting of one layer of paper tape from which the moisture had been removed and which had then been impregnated with a petrolatum compound. The insulation consisted of layers of black varnished cambric tape applied with an overlap, two layers in one direction, then two layers in the other direction until the required thickness of $\frac{13}{32}$ in. was obtained. While the insulation was being tightly wrapped, a light petrolatum filler compound, heated till it flowed freely, was applied between alternate layers. Over the insulation one layer of rubber-filled tape was applied with an overlap. The outer covering consisted of two cotton braids impregnated with a gray flame-proof paint.

The generator neutral cable consisted of a 750,000-c.m. single-conductor cable having a $\frac{1}{2}$-in. rope core and insulated with $\frac{1}{4}$-in. varnished cambric made up similarly to the generator leads. The neutral cable runs from the neutral point of each generator through fiber ducts to the neutral bus, which is grounded at one end. Provision is made to ground it through a high resistance, a low resistance or no resistance at all.

At the place of manufacture each reel was given a high-voltage test of two and one-half times the working voltage for five minutes. For the generator leads this was 37,500 volts and for the neutral cable 21,000 volts. The testing was done before the application of the outer braids, the reason being that the flame-proof finish of the cotton braids would be injured by immersion in water. Each reel was put in the test tank and covered with water to form the ground connection. The voltage was at once applied between the conductor and the water. Testing was done with 60-cycle alternating current, the source of power being a motor-generator set connected to the testing transformer. One hundred reels were tested and not one failed electrically.

An insulation-resistance test was then made on each reel and the per cent conductivity was measured, the latter being a check on the quality of the copper, its cross-sectional area and also its length. A 1-ft. sample was cut from each reel and the physical dimensions were checked.

A bending test in accordance with the National Electric Light Association specifications was made on one 15-ft. sample from each of the three different sizes of cable, after which a high-voltage breakdown test was given. The generator leads broke down at approximately 125,000 volts and the neutral cable at approximately 100,000 volts.

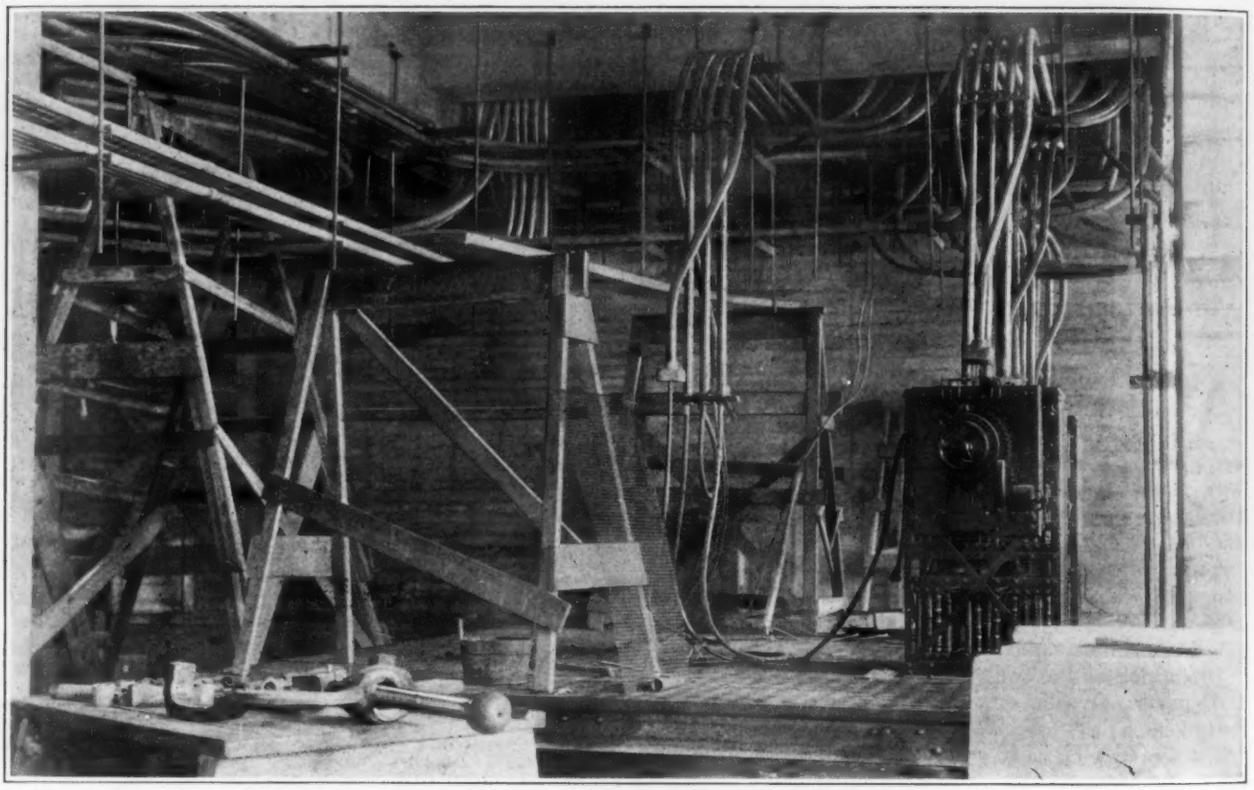


FIG. 2—CONDUIT LINES IN PROCESS OF ERECTION

The insulators that support the generator leads were made by the wet process and had tapped lugs inserted in the base and top of the porcelain and were held in place by pouring an alloy which had the same coefficient of expansion as the porcelain. The base plate was bolted to one end of the insulator and the cable clamp to the other.

Each assembled insulator with cable clamp in place was given a mechanical strength test consisting of a pull of 1,500 lb. in line with the axis of the insulator. There were no rejections from this test. An electrical flashover test was then given at 200,000 cycles per second for two minutes. The insulators began to flash over at 90,000 volts, and a vigorous flashover was obtained at 150,000 volts. There were a number of failures on this test.

A mechanical pull at right angles to the axis of the insulator of 2,000 lb. was given without any damage to the insulator.

Samples were tested to failure and for the electrical

tests they averaged 215,000 volts. For the mechanical pull test to failure the average on the samples was 8,000 lb.

The Control Cable.—The control cable was made up of the required number of stranded conductors, insulated with ¾-in. wall of 30 per cent rubber and covered with an identifying colored braid. The outer covering consisted of one rubber-faced tape and two black weatherproof braids. All control cable was run in iron pipe conduit.

It will be noted that weatherproof braid was used in place of the more commonly used lead sheath. As the location of this cable was perfectly free from moisture, no need was seen for a lead sheath.

In the few cases where part of a run was located in a damp place, as in the case of the governor-motor control cable, the braided cable on entering the power house was spliced to a leaded cable which terminated at the governor motor. Thus lighter weight and easier installation as well as lower cost were obtained.

The electrical testing of the cable at the factory consisted of a preliminary test of 1,500 volts for five minutes between conductor and ground following 12 hours immersion in the test tank. The final test after the cable was completed consisted of a dry test of 3,500 volts for five minutes between conductors.

Miscellaneous Wire and Cable.—There was a large amount of miscellaneous wire and cable for the station auxiliaries in the power house and on the dam. A small amount of lead-covered cable was specified for damp places, but the great majority had an outer covering of one layer of rubber-faced tape and two black weatherproof braids. For working pressures above 600 volts varnished cambric insulation was used, whereas for the lower voltages 30 per cent rubber was used. In the entire installation not a foot of paper-insulated cable was employed.

Installation—Generator Leads.—The generator lead cable was pulled through its cell structure by a gang of men working with a block and tackle. A heavy rope was first pulled through and the cable was then attached to it. Blocks of wood with grooves cut in them for the cable to slide over were placed every few feet in the cell structure and the cables were pulled over them to prevent injury that would have occurred if the cable had been pulled over the sharp edges of the concrete. The cable was then lifted to its place on the insulators, the slack was pulled out and the cable clamps on insulators were securely tightened.

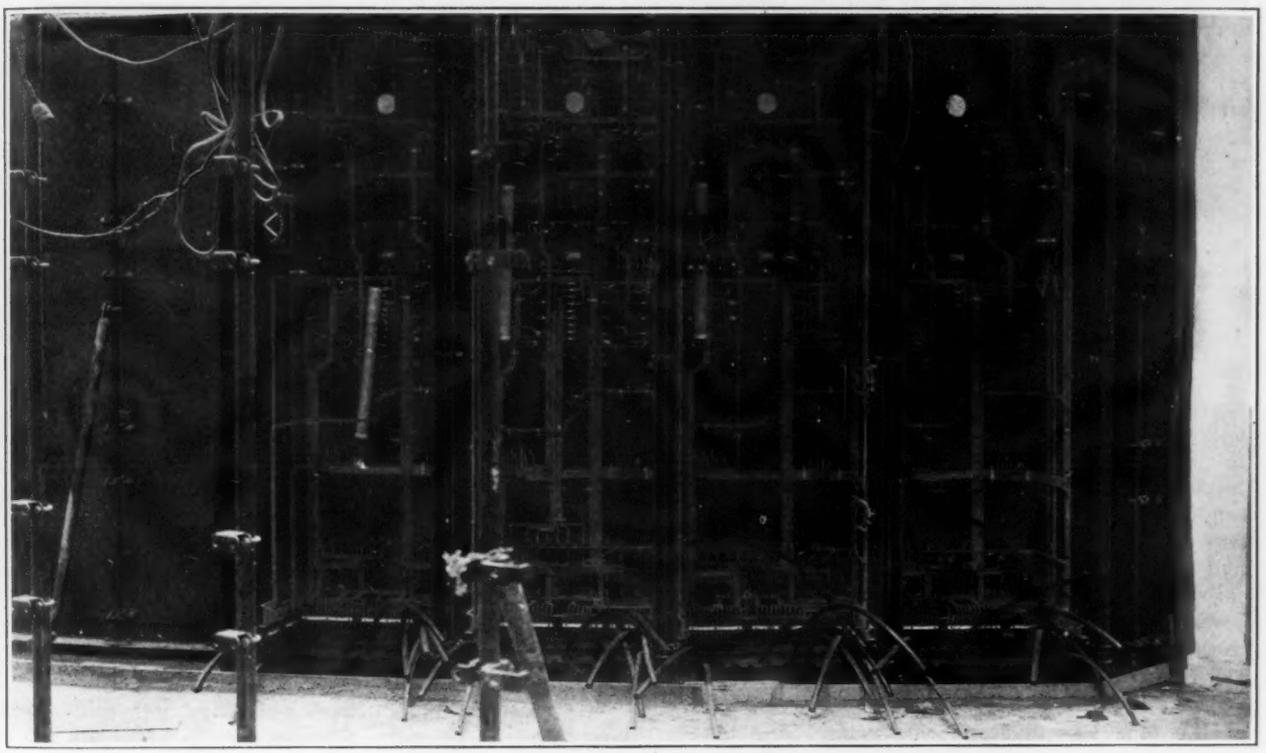


FIG. 3—VIEW OF REAR OF INSTRUMENT BOARD

Control Cable.—All control cable was installed in iron pipe conduit 1 in., 1¼ in. and 1½ in. diameters. The cable was pulled by hand, and on runs with numerous bends a block and tackle was used. From the photograph showing the control conduits it will be seen that there were numerous bends in many runs. Difficulty was encountered in some runs, but pull boxes had been liberally provided and no serious trouble resulted. The method of cable pulling was to insert in one end of the conduit a piece of cotton waste tied to a cord and by means of the air hose to blow it through. A stranded wire rope was then pulled through and a cable pulling grip was attached to its end and this was slipped over the cable. Soapstone was sprinkled liberally over the braided cable as it was being pulled in. For the few lead-covered cables grease was smeared on the sheath as it went into the conduit. It was noted before that braided cable was used in place of lead wherever possible. This showed up well during the installation work, as the braided cable was so much lighter and easier to install. The advantage of the heavy outer covering of one rubber-faced tape and two weatherproof braids was also evident, as such protection was offered to the cable that not one was injured in installation.

The terminals of the control cables were brought out to the terminal blocks on the switchboards and the wiring on the switchboard was brought to the other side of these blocks. A strip of cardboard showed the circuit symbols from the wiring diagrams and facilitated wiring. A system of tagging all control cable was used. An oval-shaped fiber tab was marked with the circuit numbers as taken from the cable and conduit list and also stated the destination of the cable. For example, "50 line O.C.B." indicated that this cable was circuit No. 50 and that it ran to the line oil circuit breaker.

All vertical runs of control cable had the cable supported by wooden wedges in its conduit; these not only supported the cable but closed the conduit to rats, dirt, etc. All control circuits were a continuous run except the cases where part of run was through a damp place, when a splice was made to a leaded cable and circuits where two control cables from different switchboards came into the same junction box and were spliced to a control cable of a greater number of conductors. All splices in control cables were in condulets or junction boxes and were made by twisting the strands together, bending them back on the conductors, soldering, insulating with pure rubber tape and friction tape.

INSPECTING AND TESTING

The inspection work during installation consisted of supervising work to see that no injury was done in pulling cables through the conduit, to watch that the proper cable got in the proper conduit; to inspect all joints; to tag both ends of every cable, and to test each conductor for continuity and with a high-voltage test between conductors and ground to see that no damage had been done during installation and that joints were satisfactory. In the testing for continuity a pair of portable telephones were used. They were attached to the opposite ends of the same two colored conductors and communication was established, then the next conductor was taken, and so on. A check on the correctness of the tags was made at this point. For the high-voltage test a portable set was constructed which consisted of a distribution transformer with a water rheostat in series with the primary for varying the voltage. A potential transformer across the secondary with a voltmeter completed the set.

The lead from the high side was attached to the end of a stick and this was touched to each conductor in making the test. All conductors were connected together and to ground except the black conductor, which was touched with the end of test stick. The white conductor was then disconnected and tested and so on until all conductors were completed, thus giving for each conductor a test between conductors and to ground.

There was not a single cable failure on test, proving the excellent quality of the cable and its installation. There were, however, several failures in splices and a rheostat with defective insulation was found. Although most installation tests are only for continuity and omit the high-voltage test, they were well worth while in this case, as they showed up the few defects in installation as well as giving greater confidence in the entire cable installation.

The entire development at Muscle Shoals was done under the direction of the United States Engineer Corps. General Harry Taylor is the chief engineer, while Hugh L. Cooper & Company were the consulting engineers.

New Electrical Engineering Building at Purdue

Large Modern Laboratories and High-Voltage Experimental Equipment Among Facilities Now Available to Students in Electrical Engineering

BY PROF. C. FRANCIS HARDING
Head of School of Electrical Engineering, Purdue University

THE largest building in the country devoted exclusively to instruction in electrical engineering is just being occupied at Purdue University, located at Lafayette, Ind. This building, as indicated in the accompanying illustrations, was designed in four units at an estimated cost of $450,000. All but two of the smaller units are now in use. The general laboratory and lecture room have been in use two years, and the high-voltage laboratory was completed in January of this year. The four-story front structure, containing general offices, recitation and design rooms, communication and research laboratories, has just been completed, permitting all of the work of the school to be moved to the new site.

The structure is 220x180 ft. in plan, with laboratories and classrooms surrounding a central lecture room seating 480 students, accessible from both the front corridor and the laboratory in the rear. Upon three sides the ultimate building will comprise a ground floor and three upper stories.

The main laboratory is 160x60 ft., flanked by a computation gallery throughout its entire length and served by a 10-ton crane. Connecting with one end of this main laboratory and served by the same crane is the high-voltage laboratory. The latter is 60x53 ft., with a clearance under roof girders of more than 30 ft. It is equipped for a maximum of 600,000 volts at present, with provision for an ultimate voltage of 1,000,000 volts single-phase or 300,000 volts to neutral three-phase. Senior and graduate courses in extra high-voltage phenomena are offered, for which this becomes the accompanying experimental laboratory. Senior theses, which are required of all students securing the Bachelor of Science degree in electrical engineering, were completed this year by twenty students, requiring experimental research in this high-voltage laboratory. In addition to the experimental work carried on by students, two research assistants in the employ of the electrical division of the engineering experiment station are devoting full time to high-voltage research and commercial testing.

The two 300-kv., 135-kva. transformers in this laboratory may be used for floor tests or may be connected through the 9-ft. wall openings to the transmission line, 1,700 ft. in length, located immediately in the rear of the new building. Upon this line corona and other high-voltage tests are conducted, with possible variation of conductor sizes and spacings for voltages up to 600 kv. between cables. Other equipment includes a 100-kv. lightning generator that produces steep-wave-front discharges simulating those of lightning. From this generator 10,000 amp. is discharged in less than one micro-second with the usual accompanying cannon-like report and distinctive vaporization of objects in its path.

An electrically interlocked gate is provided so that no one can open the only passage to the test floor when the power is on, nor can the power be applied until

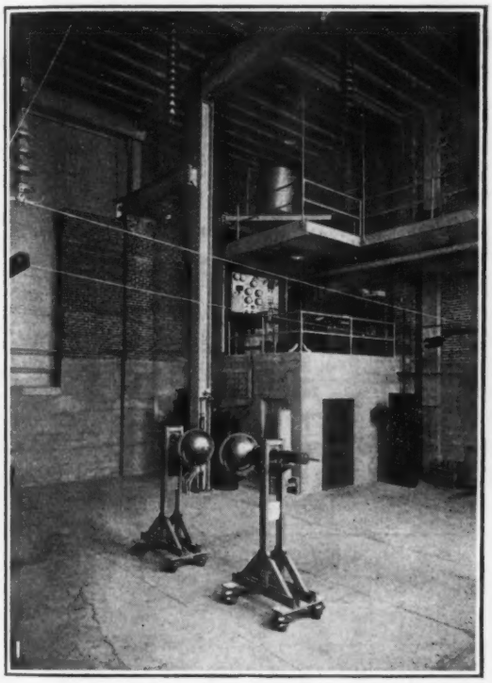
the control circuit is closed by operators on both test floor and control gallery. Red lights upon all columns of the test floor and at the entrances to the laboratory are always lighted when power is on the test circuits. The primary control of one or both 300-kv. transformers is provided with 480 equal increments of voltage by means of an auxiliary supply transformer and motor-operated double-drum controller. A recently developed apparatus used in connection with this high-tension work photographs the actual dielectric field surrounding full-sized insulators and line hardware secured under various standard line voltages. Such photographs, which are described in a forthcoming bulletin of the Engineering Experiment Station, will provide a ready means for the study of dielectric fields and insulator designs.

All power measurements are made directly in the high-voltage circuit at ground potential upon meters located upon the control desk, whereas voltages are determined by means of both crest voltmeter and transformer voltmeter coils calibrated against a standard sphere gap. Distilled and cistern water that comply with the A.I.E.E. standards with respect to resistivity are available at the columns on the test floor, and in addition compressed air, city water and gas are supplied for special tests.

One feature of the new building that is expected to prove of particular value for senior and graduate thesis and research work is the equipment of several rooms on the ground floor for such purposes with power supply, various trunk feeders for interconnection with other laboratories and with compressed air, gas and water supply. Such rooms, assigned for a definite project to an instructor or group of students, may be fitted up with special equipment and locked at all times when not in use. Instrument standardization, watt-hour meter and vacuum tube laboratories are also planned upon the ground floor, together with storage battery and switchboard rooms and shops.

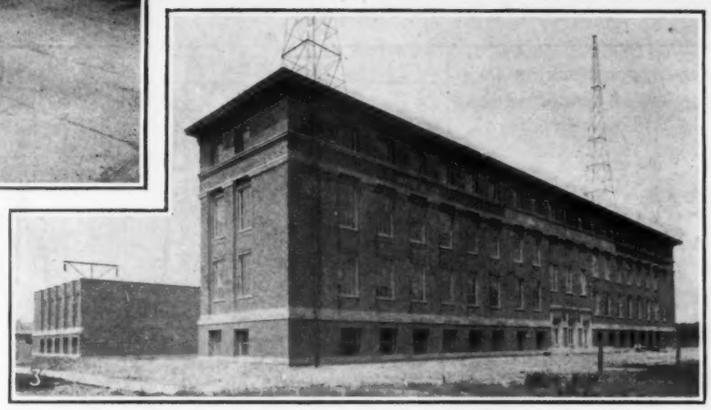
The first and second floors of the front structure are devoted to offices and recitation rooms, the latter being of all sizes accommodating from 24 to 60 students each. The third floor accommodates the design and communication departments, the latter being divided into radio and telephone laboratories and a broadcasting station, W B A A, from which educational programs are broadcast two evenings a week.

With this excellent building and its equipment, manned by a staff of eighteen, the School of Electrical Engineering of Purdue University will be able to instruct more adequately the group of more than 600 electrical engineering students and about 1,300 other engineering students whose courses involve electrical engineering subjects at some period during their four years at the university. Furthermore, the thesis, research and graduate instruction may now be greatly expanded and the Engineering Experiment Station researches, particularly in extra high-voltage phenomena, may be carried on with adequate facilities for the work.



NO. 1—CORNER OF HIGH VOLTAGE LABORATORY, SHOWING CONTROL GALLERY

NO. 2—MAIN LABORATORY FLOOR, ELECTRICAL ENGINEERING BUILDING



NO. 3—NEW ELECTRICAL ENGINEERING BUILDING, PURDUE UNIVERSITY, LAFAYETTE, IND.

Business Index that Served Utility

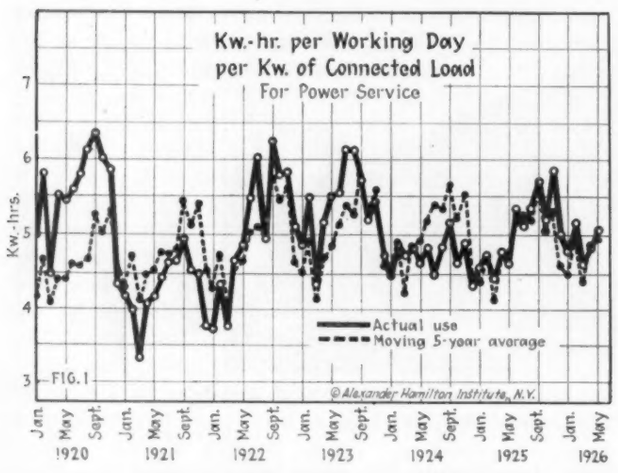
Based on Extent to Which Industrial Customers Utilize Their Connected Load—Calculated from Monthly Meter Readings—An Aid to All Departments, Particularly Power-Sales Development

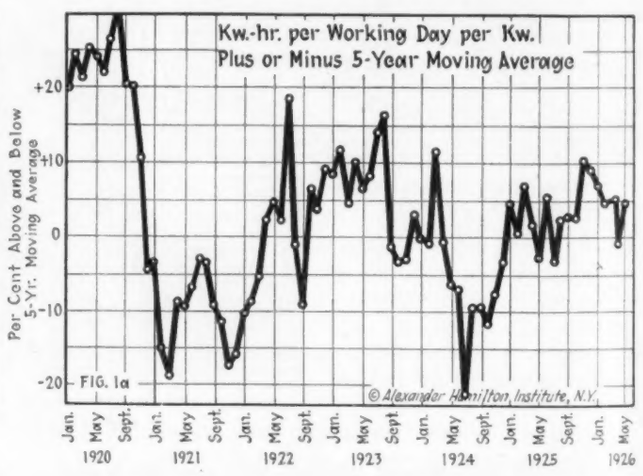
TO SERVE as one guide in conducting the activities of its power-sales department, the Public Service Company of Northern Illinois has long employed some form of local business barometer. During the past four years its barometer has been based on the extent to which its industrial customers are utilizing their power-operated production equipment. More specifically, the index involves the "kilowatt-hours per working day per connected kilowatt." Adjusted for seasonal changes, this index indicates changes in industrial production the instant they occur, or at least as soon as the industrial managers commence to increase or decrease production. The electric-service company can ascertain these conditions as soon as monthly meter readings are available.

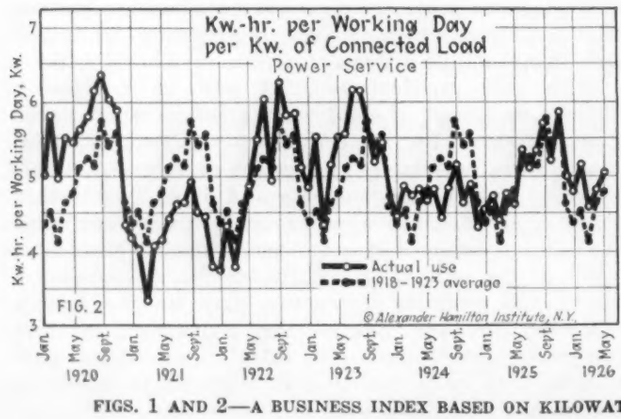
ANTICIPATION OF SLUMPS AND IMPROVEMENTS

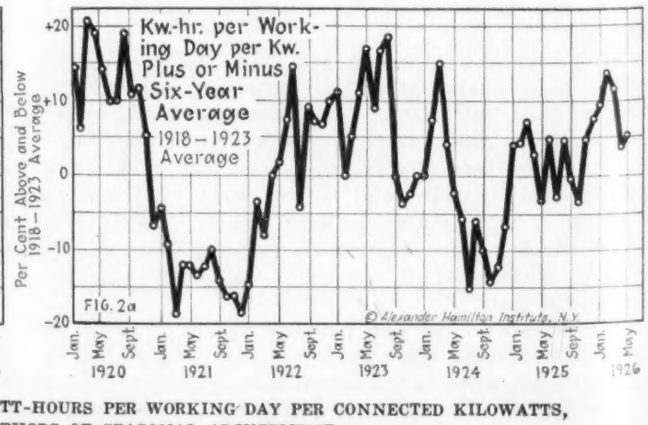
Although a barometer that would anticipate slumps and improvements would be more desirable, the Public Service Company has not yet found readily available data on conditions that presage local business conditions any more promptly. The index now employed does help to utilize the sales staff more efficiently. For example, signs of slackening business indicate that the utility-sales department can most effectively emphasize economy of electrical operation on purchased power, as the customers are then vitally interested in increasing their margins of profit to tide over the period. More time is afforded then to undertake promotional work such as exhaustive reports requiring attention that cannot be given so conveniently during active periods. In times of prosperity the customers do not hold their money so closely and are usually interested in the availability of reliable and unlimited power supply or applications that will help them increase production. However, less time is usually afforded for economic reports on the value of purchased power, as more time must be spent in providing the customers with increased service facilities or helping them with their new application problems.

This index of business conditions is also valuable to the financial, engineering and operating departments. For the two last-named departments it gives some basis for judging the rapidity with which additional power or service may be required. Banks and chambers of


Kw.-hr. per Working Day per Kw. of Connected Load For Power Service
Kw.-hrs.
Actual use
Moving 5-year average
FIG. 1
© Alexander Hamilton Institute, N.Y.
Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May
1920 1921 1922 1923 1924 1925 1926


Kw.-hr. per Working Day per Kw. Plus or Minus 5-Year Moving Average
Per Cent Above and Below 5-Yr. Moving Average
FIG. 1a
© Alexander Hamilton Institute, N.Y.
Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May
1920 1921 1922 1923 1924 1925 1926


Kw.-hr. per Working Day per Kw. of Connected Load Power Service
Kw.-hr. per Working Day, Kw.
Actual use
1918–1923 average
FIG. 2
© Alexander Hamilton Institute, N.Y.
Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May
1920 1921 1922 1923 1924 1925 1926


Kw.-hr. per Working Day per Kw. Plus or Minus Six-Year Average 1918–1923 Average
Per Cent Above and Below 1918–1923 Average
FIG. 2a
© Alexander Hamilton Institute, N.Y.
Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May
1920 1921 1922 1923 1924 1925 1926

FIGS. 1 AND 2—A BUSINESS INDEX BASED ON KILOWATT-HOURS PER WORKING DAY PER CONNECTED KILOWATTS, SHOWING EFFECT OF TWO METHODS OF SEASONAL ADJUSTMENT

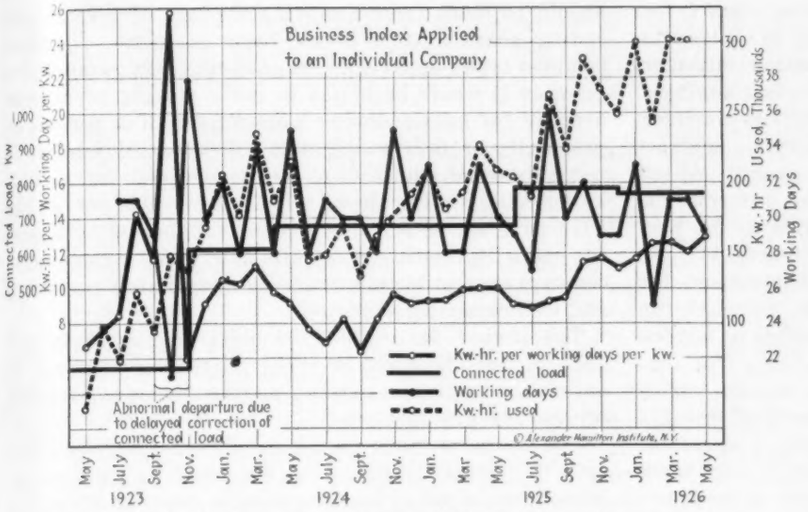

Business Index Applied to an Individual Company
Connected Load, Kw
Kw.-hr. per Working Day per Kw.
Kw.-hr. Used, Thousands
Working Days
Kw.-hr. per working days per kw.
Connected load
Working days
Kw.-hr. used
Abnormal departure due to delayed correction of connected load
© Alexander Hamilton Institute, N.Y.
May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar May July Sept Nov. Jan. Mar. May
1923 1924 1925 1926

FIG. 3—INDEX APPLIED TO A SINGLE CUSTOMER BUT UNADJUSTED FOR SEASONAL VARIATION

commerce have also indicated an interest in the barometer. Individual industrial plants, by calculating their own kilowatt-hour consumptions per working day per connected load, adjusting for seasonal demand and comparing with the general barometer based on the same factor, can ascertain how their own business is tending compared with general business.

Index Compared with Others

Comparisons of this business index with a few other indexes are shown in the accompanying diagram. No conclusions have been reached as a result of these comparisons. However, it is believed that car loadings, interest rates and other business indexes are more a measure of conditions after production has actually occurred, whereas the "Public Service index" measures the degree of production in process. As the individual industrial plants find orders slackening their tendency to reduce production will be indicated as quickly as the kilowatt-hour per working day per connected load is calculated; likewise any overproduction.

The index has been applied to one individual plant, as shown by the accompanying curves, to ascertain how well it checks with that plant's own measure of business during the same period. The report from the customer is that the index shows exceptionally well what the actual conditions were.

The business index measures the degree of use of all power-operated equipment in industrial plants, since commercial, domestic and other utility consumptions are omitted. Therefore the index is proportional to production and makes an attractive basis for estimating business activity. Of course radical changes in production methods may greatly affect the factor for individual plants, but considered in the aggregate, these changes are gradual, so that the removal of seasonal variations (based on the average of several years previous) irons out fluctuations from such causes to a great extent.

The method of correcting for seasonal variations is considered at the present time the factor that must be given major consideration if the index is to be made of maximum value. Errors in connected load would throw off the index, but this value is kept fairly accurate for other purposes anyway. The factor "working days" is included to compensate for months having different number of calendar days, Sundays and holidays.

Method of Calculating

Time required for keeping up such an index is a factor that determines largely the advisability of any company maintaining one. In the Public Service Company of Northern Illinois maintenance of the index does not require much time that can be specifically charged to it, because the data used are collected and employed for other purposes that fully justify their collection. Only a few minutes each month is required in the power-sales department to keep the index up to date.

As an example, assume that the total consumption for power business in January was 19,200,000 kw.-hr. and the connected load was 160,000 kw. There were 25 working days in this month. Therefore

$$\text{Kilowatt-hours} \div (\text{working days} \times \text{kilowatts}) = 19{,}200{,}000 \div (25 \times 160{,}000) = 4.8$$

The corresponding "five-year moving average," which is used for making the seasonal adjustment, is obtained by dividing the sum of the last five years' indexes (same month in each case) by five. For example, the last five yearly indexes for January might be 3.74, 4.86, 4.45, 4.56 and 4.8 respectively, giving an average of 4.48. For the particular month considered, therefore, business, as measured by the factor chosen, is 4.8 — 4.48 ÷ 4.48 or 7.13 per cent above the average for the same month during the previous five years.

Where Data Come From

For preparation of the index, the total connected power load in kilowatts and the total monthly consumption of this load are obtained from the statistical department. The consumption is readily obtainable by the statistical department from meter-reading records of individual customers. It is probably due to this company's method of handling power business that the connected load is relatively easily obtained. First of all, the demand charge is based on a certain proportion of the connected load, so the latter must be known for this purpose. In addition, whenever new or additional business is secured, the power salesman fills in a

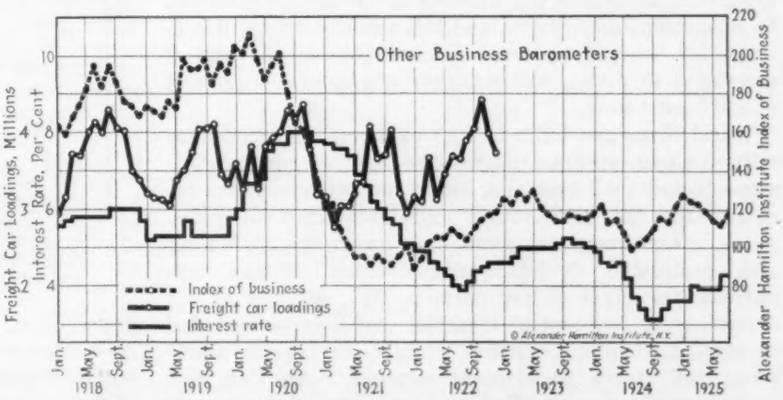

Other Business Barometers
Freight Car Loadings, Millions
Interest Rate, Per Cent
Alexander Hamilton Institute Index of Business
Index of business
Freight car loadings
Interest rate
© Alexander Hamilton Institute, N.Y.
Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May Sept. Jan. May
1918 1919 1920 1921 1922 1923 1924 1925

FIG. 4—COMPARISON OF NEW INDEX WITH SOME OTHER INDEXES OF BUSINESS CONDITIONS

"Notice of Power Contract," giving, among other information, the connected load converted to kilowatts. Copies of this notice go to the production manager, electrical engineer, distribution engineer, test engineer, meter supervisor, statistician, auditor, district manager, district engineer, district meter foreman, contract agents, power salesman and power engineer. All of these men are vitally interested in the information, because it helps them to provide service or to plan future work affected thereby. These records are not employed directly by the statistical department for totalizing connected load, but are used to check up loads reported by the meter installers, testers or anyone else who is required to report connected load. The connected load is really based on reports of the meter department, these records being checked and brought up to date when a meter is installed, changed or tested.

Time that should be devoted to productive sales work has not been spent in developing this index or in determining how it could be improved, but considerable thought has indicated that the seasonal adjustment should be made from a moving average of several preceding years until a better basis is found. Because business cycles apparently occur about every seven years, possibly it would be better to use a moving seven-year average for adjustment to balance preceding periods of prosperity or depression, it is believed. At least it is not considered advisable to adjust seasonal fluctuations by applying an average of a fixed immovable period like 1913 to 1923, or for that matter any period that does not end with the current month, as it is more common to compare current business with an immediately preceding and well-remembered period.

The proper basis for a business barometer is still open to consideration, it being particularly desired to anticipate conditions as much as possible from data that are readily available.

The business index used by the Public Service Company of Northern Illinois was developed by Emerson A. Armstrong, head of the power-sales department of the company. John Learned, vice-president of the company, is in charge of all commercial activities.

Allocating Rural Service Costs

Method of Defining Responsibilities of Farm Customers for Plant Investment Required to Serve Them—Importance of Increasing Energy Consumption in Reducing Unit Prices

By LEON C. WHITE
Manager Twin State Gas & Electric Company, Bennington, Vt.

FOLLOWING an extended study of rural service costs and methods of financing line extensions, the Twin State Gas & Electric Company recently established a convenient means of allocating such costs to farm customers, based on clearly defining the needs of each situation before prorating the burdens. Rural service we define as service rendered from lines built primarily for that purpose or from extensions built to serve customers living outside the corporate limits of any city, village or town who cannot be served economically from existing distribution systems.

When one or more prospective rural customers make application for electric service, we will investigate the extension, ascertain the number of customers who can be advantageously served and the number who will contract for service under the terms prescribed; and if requested to do so, will estimate the construction cost as outlined below.

Rural lines are built by the company in accordance with its own specifications. The cost of rural extensions includes all material, labor and other expense required for the distribution and installation of poles, wires, cross-arms, insulators, line hardware, switching and protective devices, transformers, meters, appurtenances, right-of-way permits, etc. An item of not exceeding 10 per cent of material cost may be included to cover purchasing expense, freight, cartage to storeroom and stores department expense. An item not exceeding 15 per cent of all above-mentioned items may also be included to cover general overhead, engineering, promotion, office supervision, clerical labor, contingencies, etc. All rural lines are financed by the company.

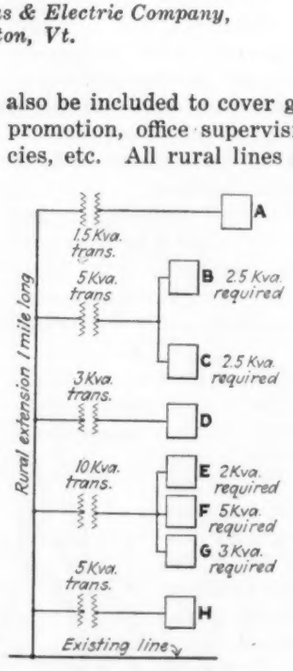


FIG. 1—TYPICAL LINE EXTENSION SERVING EIGHT CUSTOMERS

Rural service is furnished by the company to customers directly from transmission lines when rural lines are not available and when service and voltage conditions render such service feasible. Service from transmission lines having voltages in excess of 13,200 volts are treated as special by the company and do not come within the operation of the regular rates, rules and regulations for rural service.

The fixed charges for customers served from lines built under our rules and regulations when the line serves both rural customers and urban customers are apportioned between such classes of service in those cases where the revenue to be derived from such urban business alone is not sufficient to justify the building of the extension, and the proportion which each class of

service shall bear is determined by agreement of the parties interested, or, at their request, by the Public Service Commission of Vermont.

RATE FOR RURAL SERVICE

The company supplies service at charges determined and apportioned according to the methods hereinafter set forth.

Excess Investment Charge.—A monthly fixed charge consisting of one-twelfth of the sum of the following three amounts:

A. Company's general investment: $9 per kilovolt-ampere per year for each kilovolt-ampere of installed transformer capacity.

B. Company's special investment: 15.5 per cent per year of the total investment of the company assigned to the customer in transmission and/or farm lines, transformer, protective devices, service connections, etc.

C. Extraordinary costs: $12 per year to cover core loss, reading of meters, etc.

Energy Charge: In addition to the service charge, all energy used shall be paid for at the following rates: First 30 kw.-hr. per month at 5c. per kilowatt-hour; all over 30 kw.-hr. per month 3c. per kilowatt-hour.

Discount: A discount of 10 per cent will be allowed on the energy portion of the bill if paid within ten days of date of bill.

Minimum Bill: The net charge for energy under "Energy Charge" above shall not be less than $1 per month.

Determination of Customer's Service Charge.—The following rules govern the computation of service charges:

Company's General Investment: The rated capacity of the transformers installed for each customer shall control. Where two or more customers are connected to the same transformer, the total connected load of each is taken as determining the proportion of transformer capacity assignable to each customer.

Company's Special Investment: The principal amount upon which the annual charge of 15.5 per cent is computed is that proportion of the local transmission line and/or farm extension plus the total amount invested by the company in transformers, protective devices, service connections, etc., for the supplying of energy to that customer. The company at its option may require the customer to read his own meter and report such reading on a suitable form furnished by the company. Such reading will then be supplemented by periodic reading by representatives of the company. The company performs all maintenance and service work on the rural lines, transformers, protective devices, service connections, etc., which may be required to furnish satisfactory service. It inspects the installation of the rural customer before service is furnished. Such installations must conform to the rules of the company and be approved by its inspector before meters will be installed. In the event the customer desires at any time to add any equipment to his installation, he must first notify the company so that the proper transformer and meter equipment may be provided. The company reserves the right of free access by any of its authorized employees to the customer's premises at all reasonable times for the purpose of reading meters or inspecting any of the equipment.

Term of Contract.—Rural service will be supplied by the company under contract with each individual customer. Such contracts shall be for a term of one year, continuing in force thereafter from year to year. If the customer is in default in the payment of bills rendered by the company for a period of 30 days or more, the company may, at its option, discontinue service to such customer, but such discontinuance does not abrogate any of the rights of said company under its contract.

Connection of Additional Customers. — When an additional customer desires service from an extension served under these rates, rules and regulations, service will be given and the service charge to the prior customers will be adjusted pro rata. Nothing in our rules and regulations is deemed to determine the connection charges or basis of service to the hamlets, towns or communities, service to which is made available by the construction of such lines, such connection charges, and basis of service being expressly reserved for separate consideration and adjustment in view of the particular circumstances and facts pertaining thereto. The standard of construction of rural lines must conform with the construction standard of the company, and to the rules and regulations of the Vermont Public Service Commission.

Construction Prior to 1926 Determination of Cost.—The rates, rules and regulations established contain certain elements dependent upon the amounts invested by rural customers and the company. Such amounts are determined from the books of the company in so far as possible. Where such process is not possible, due to construction of lines by parties other than the company, or due to loss of record, the company prepares an estimate of the cost of said line or lines to be used in lieu of actual costs and presents this to the customer or customers. In case of disagreement, the Public Service Commission of Vermont is asked to arbitrate. The respective amounts contributed by rural customers and the company are also determined from the books of the company in so far as possible aided by customer's receipts or other evidence when presented by the customer in substantiation of his claim.

EXAMPLE OF METHOD OF DETERMINING CUSTOMER'S SERVICE CHARGE IN THE RURAL SCHEDULE

1. Cost of extension exclusive of transformers, services and arresters, $1,000.

2. Fixed charges on above amount per Item B, $1,000 × 15.5 per cent = $155.

3. This sum is to be divided equally among all customers; $155 ÷ 8 = $19.37 per year per customer.

4. In addition to 2 above, each customer pays 15.5 per cent on cost of his service or his individual extension from main rural extension to his premises.

5. Under Item A, a charge is made to cover the company's investment up to the point where the rural extension starts. This charge is based on installed transformer capacity and is prorated where more than one customer is served from a transformer.

6. Item C is self-explanatory.

For Customer "A" these fixed costs would be as follows:

Item A, 1.5 kva. × $9			$13.50
Item B, pro rata of item 2 above			19.37
Plus 15.5 per cent on investment for this customer as below:			
Transformer	$40.00		
Service	7.00		
Arresters	12.00		
	$59.00 × 15.5 per cent		9.14
Item C			12.00
Yearly charge			$54.01
Per month			4.50
For customer "B":			
Item A, 2.5 kva. × $9			$22.50
Item B, pro rata of item 2 above			19.37
Plus 50 per cent of fixed charges on transformer and arresters:			
Transformer	$80.00		
Arresters	12.00		
	$92.00		
$92.00 ÷ 2 =	$46.00		
Service $7.00 +	53.00 × 15.5 per cent		8.21
Item C			12.00
Yearly charge			$62.08
Per month			5.17
For customer "C" Same as "B"			
For customer "D"			
Item A, 3 kva. × $9.00			$27.00
Item B, pro rata of item 2 above			19.37
Plus 15.5 per cent on			
Transformer	$56.00		
Arresters	12.00		
Service	7.00		
	$75.00 × 15.5 per cent		11.62
Item C			12.00
Yearly charge			$69.99
Per month			5.83
For customer "E" This customer requires 2-kva. capacity of the 10-kva. transformer which serves E, F and G.			
Item A, 2 kva. × $9.00			$18.00
Item B, pro rata of item 2 above			19.37
Plus 2 kva. ÷ 10 kva. = 20 per cent of fixed charges on			
Transformer	$125.00		
Arresters	12.00		
	$137.00		
137.00 × 20 per cent	27.40		
Service	24.00		
	$51.40 × 15.5 per cent		7.97
Item C			12.00
Yearly charge			$57.34
Per month			4.78

For customer "F"
This customer requires 5-kva. capacity of the 10-kva. transformer which serves E, F and G.

Item A, 5 kva. × $9.00		$45.00
Item H, pro rata of item 2 above		19.37
Plus 5 kva. ÷ 10 kva. = 50 per cent of fixed charges on		
Transformer	$125.00	
Arresters	12.00	
	$137.00	
137.00 × 50 per cent	68.50	
Service	12.00	
	$80.50 × 15.5 per cent	12.48
Item C		12.00
Yearly charge		$88.85
Per month		7.40

For customer "G"
This customer requires 3-kva. capacity of the 10-kva. transformer which serves E, F and G.

Item A, 3 kva. × $9		$27.00
Item B, pro rata of item 2 above		19.37
Plus 3 kva. ÷ 10 kva. = 30 per cent of fixed charges on		
Transformer	$125.00	
Arresters	12.00	
	$137.00	
137 × 30 per cent	41.10	
Service	32.00	
	$73.10 × 15.5 per cent	11.33
Item C		12.00
Yearly charge		$69.70
Per month		5.83

For customer "H"

Item A, 5 kva. × $9		$45.00
Item B, pro rata of item 2 above		19.37
Plus 15.5 per cent on		
Transformer	$80.00	
Arresters	12.00	
Service	10.00	
	$102.00 × 15.5 per cent	$15.81
Item C		12.00
Yearly charge		$92.18
Per month		7.68

Summarized, we have an investment in the rural extension for eight customers who require 24.5-kva. capacity, of	$1,547.00
This is per customer	193.35
And per kilovolt-ampere	63.14
The total of the "excess investment charges" amounts to	$556.23
Of which fixed costs on rural extension are	239.73
Fixed costs on present investment are	220.50
Core losses, reading meters, etc.	96.00
Core losses amount to 1.648 kw.-hr., which at 1½ cents costs us	24.72
Leaving us a balance for trouble calls, etc., of	71.28
Which is per customer	8.91
And is per customer per month	.74
The fixed costs on company's general investment, which is item "A," is as above	220.50
This is 15.5 per cent of an investment of	1,422.58
And this is per customer	177.82
And per kilovolt-ampere	58.06
This item of $58.06 per kilovolt-ampere is a low figure for investment per kilovolt-ampere, but diversity warrants using it. If the maximum requirement of the customers is 8 kilovolt-ampere, we obtain a diversity factor of 8 + 24.5, or 32.6 per cent and an investment per kilovolt-ampere of	177.82
which is a reasonable figure.	
Taking the first figure for general investment	$58.06
And the investment per kilovolt-ampere on the rural extension.	63.14
We have an investment of per kilovolt-ampere	$121.20
And per customer of	$371.17

Taking Customer "A," we find that his cost per kilowatt-hour will decrease rapidly with increased use of electricity.

Kw.-hr	20	40	60	80	100	120	140	160	300
Excess inv. chg.	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Energy	1.00	1.80	2.40	3.00	3.60	4.20	4.80	5.40	9.60
Discount	Net	.18	.24	.30	.36	.42	.48	.54	.96
Total bill	5.50	6.12	6.66	7.20	7.74	8.28	8.82	9.36	13.14
Cents per kw-hr.	27.5	15.3	11.1	9.0	7.7	6.9	6.3	5.8	4.38

Under the article concerning connection of additional customers, if an additional customer or customers require an extension to the existing rural line and the fixed costs of this extension are greater per customer than those which prevail on the original line, the new customers should carry the burden, but if by reason of adding customers to an existing line the fixed costs per customer can be reduced this should be done.

It will be necessary to keep an accurate record of each rural line, showing investments, etc., in order that proper division of charges may be made.

In the foregoing example there has been set up eight customers per mile. If there were but three per mile, the net cost per kilowatt-hour would of course run higher. If we take Customer "D" above, who has a 3-kva. transformer, we find that his fixed cost would be as follows with only three customers per mile:

Item A, 3 kva. × $9		$27.00
Item B, pro rata of item 2		51.66
plus 15 5 per cent on		
Transformer	56.00	
Arresters	12.00	
Service	7.00	
	$75.00 × 15.5 per cent	11.62
Item C		12.00
Yearly charge		$102.28
Per month		8.54

His cost per kilowatt-hour per month for various kilowatt-hours is as below.

Kw.-hr	50	100	200	300	500
Excess inv. chg	8.54	8.54	8.54	8.54	8.54
Energy	2.10	3.60	6.60	9.60	15.60
Discount	.21	.36	.66	.96	1.56
Total bill	10.43	11.78	14.48	17.18	22.58
Cents per kw.-hr.	20.8	11.7	7.1	5.7	4.5

This table indicates that if the farmer will use electricity for all possible uses he will find it reasonable under this schedule.

Rural Electric Service in Britain

ONE large field for extension of electric service in Great Britain, which was the subject of a contribution to the British Association from R. Borlase Matthews at the recent annual conference of that body, is that of agriculture. The farmer was said to require more power than all other industries combined, and Mr. Matthews insisted that the time has arrived when the engineer should investigate this field. He claimed that for plowing the cost per acre is lower than for the fuel in the non-electric types of plow and that there should, besides, be an increase of marketable produce and a reduction of labor costs.

Frank Ayton enlarged upon this subject at a recent meeting of the Institution of Mechanical Engineers at Ipswich, the English center of the agricultural engineering industry. The application of electric power to plowing is not, according to Mr. Ayton, merely dependent on the design and construction of suitable units. Usually where steam plowing machinery is used it is worked by contractors who go from farm to farm. The steam unit is self-contained and effects its own transport from place to place. In Continental Europe electric plowing has been done by cable hauling, it being a simple matter to substitute an electric motor for the steam or oil-driven set. This, however, requires that the farm should be equipped with constant electric supply from a public transmission system. Until this is done it is not likely that the plowing contractor will look with favor upon a type of plant which, even though in cost of operation it compares favorably with steam or oil, has to depend on some other means than electricity to haul it from place to place. Though this difficulty has to some extent been overcome by the provision of a separate oil engine, the combination, Mr. Ayton said, compares unfavorably with a completely mobile set. Notwithstanding this, however, the electric plow has come into use in some localities in England.

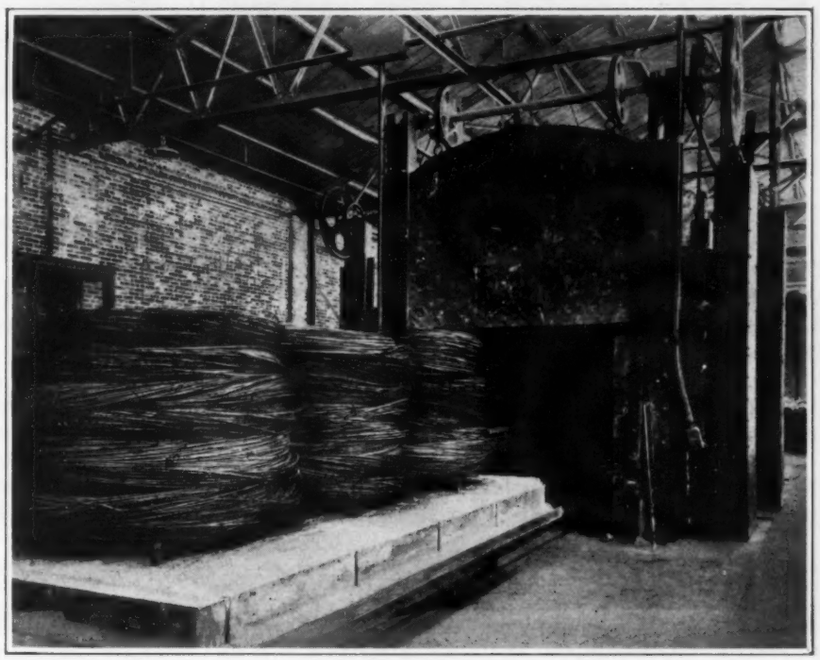
Electrically Annealed Horseshoe Nails

Installation of Regenerative Car-Type Electric Furnace in Plant of Fowler & Union Horse Nail Company Shows Low Operating and Maintenance Costs

FOR the last six years the Fowler & Union Horse Nail Company, Buffalo, manufacturer of horseshoe nails and chill nails for use in steel and gray-iron castings, has been using a 180-kw. electric furnace for annealing steel wire with exceptionally satisfactory results. Since its installation O. L. Dibble, general manager of the Fowler & Union company, says that the furnace has turned out nearly 10,000 tons of annealed wire without a single rejection or reheating.

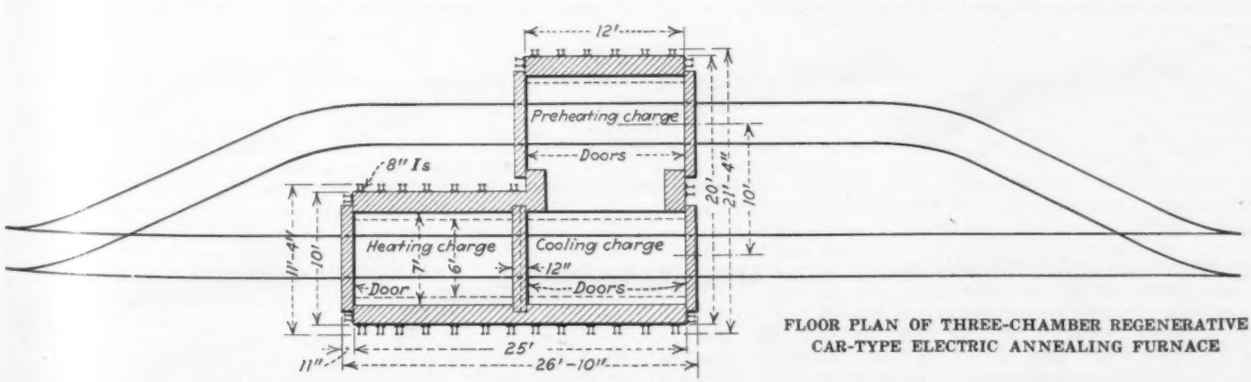
The annealing equipment, which is a regenerative car-type furnace, designed and installed by the George J. Hagan Company, consists of three chambers each 10 ft. long, 6 ft. wide and 4 ft. high, inside dimensions. One chamber is used for direct heating of the charge, one for cooling and one for preheating. As shown in the accompanying floor plan, the heating and cooling chambers are set in tandem with a common door between, and the preheating chamber is placed alongside the cooling chamber with a full side opening between to allow free passage of heat from the hot to the cold charge. The furnace is built up with refractory walls using "Sil-O-Cel" as an insulating material. The outside surface is incased in steel plate supported by rugged structural members. Electrical heating units are installed in the heating chamber only and consist of heavy nickel-chromium ribbon suspended on the side walls by means of special refractory insulators. The normal rating of the furnace is 180 kw. at 440 volts, and the heating units are designed for operation on the regular three-phase power circuit in the plant without special transformers.

Temperature control is automatic by means of a General Electric heater panel actuated by a Leeds & Northrup two-point control instrument with a temperature scale from 200 deg. to 2,000 deg. F. This instrument records the temperatures of both the heating unit and the charge and functions as a controller as well. Neither the temperature of the ribbon nor the charge can exceed the predetermined value.

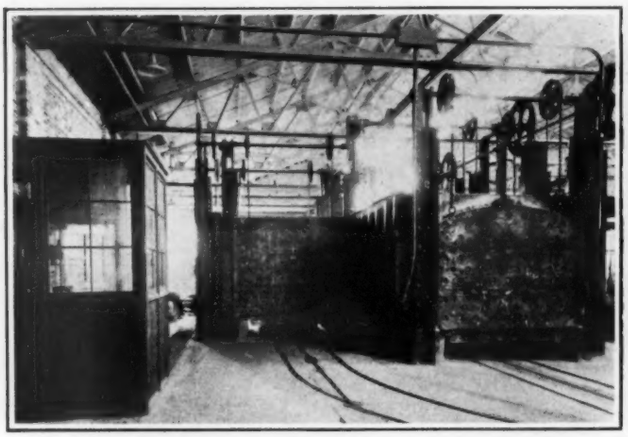


CHARGE OF 7,500 LB. WIRE ENTERING FURNACE

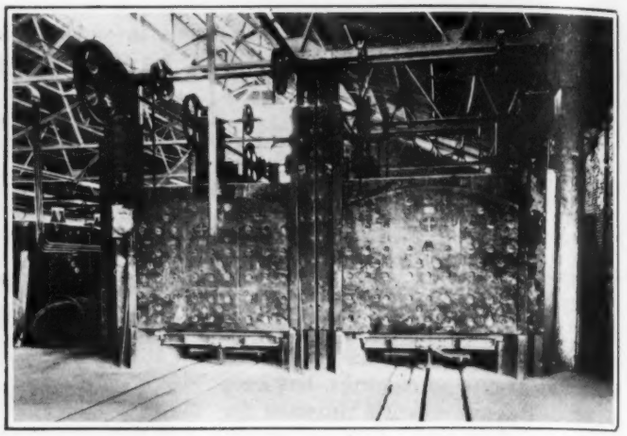
Furnace cars for handling the wire through the annealing operation are of the swivel-truck type with heavily insulated floors, and on all four sides of each car "Sandseal" troughs are provided so that the furnace can be sealed when in service. The cars are moved into and out of the furnace by a special mechanism designed by G. M. Lange, engineer of the Fowler & Union Horse Nail Company. It consists of two endless chains installed parallel to each other below the floor level, one passing under the track through the heating and cooling chambers and the other under the track through the preheating chamber. The chains are provided with steel



FLOOR PLAN OF THREE-CHAMBER REGENERATIVE CAR-TYPE ELECTRIC ANNEALING FURNACE



VIEW OF 180-KW. ELECTRIC ANNEALING FURNACE, SHOWING PREHEATING AND HEATING CHAMBERS



COOLING AND PREHEATING CHAMBERS OF FURNACE, SHOWING CONVEYOR DRIVE CONTROL

In the first view the temperature control panel is inclosed on extreme left.

dogs spaced at car length intervals which engage in lock-bar pins. Cars may be operated in either direction. The conveyor drive control is installed at the extreme end of the furnace room adjacent to the air-valve control for operating the five furnace doors. With this equipment the furnace operator with one assistant can complete the entire cycle of shifting the cars in the heating, cooling and preheating chambers in about seven minutes.

MATERIAL TREATED

The material annealed consists of $\frac{3}{8}$-in. wire from which horseshoe nails are made. The stock used is steel of low carbon and sulphur content approaching wrought iron in its composition. It is important in the use and manufacture of horseshoe nails that they be stiff enough not to buckle in driving and at the same time be soft enough to bend over and clinch without breaking. Use of the electric furnace makes possible an absolute uniformity of anneal on every charge. The wire is delivered to the furnace in 250-lb. coils and the charge per car is approximately 7,500 lb. Coils are stacked on the cars on steel spiders which hold the lower coil about 3 in. off the floor to permit of free circulation of heat.

CYCLE OF OPERATION

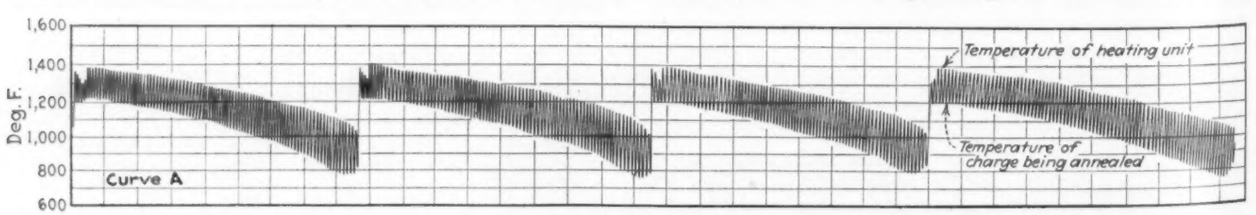
The charge remains in each of the three chambers for a period of three hours. The complete cycle of operation is as follows: A cold charge is first placed in the preheating chamber, where it absorbs heat from the cooling charge. After a three-hour period this charge is taken out of the preheating chamber and introduced into the heating chamber, where it remains another three hours. At the end of this time the charge is carried into the cooling chamber, where it radiates heat on a new cold charge in the preheating chamber. The furnace thus delivers one 7,500-lb. charge of annealed wire every three hours.

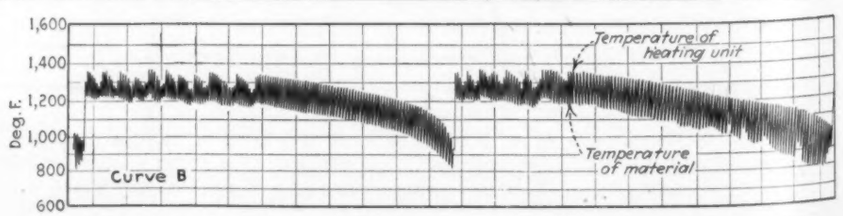
The accompanying charts show graphically the temperature curves in the furnace during the heating period. The upper points on the curve indicate the temperature of the heating element, while the lower points indicate the temperature of the charge itself. Curves *A* were taken when the furnace was in operation continuously twenty-four hours a day. The uniformity of the heating period is particularly noticeable. Curves *B* were taken when wire, which required a soaking period of approximately one hour, was being annealed. A series of tests conducted on the furnace to determine the energy consumption per ton of wire annealed under varied conditions is shown in the accompanying table.

ENERGY CONSUMPTION FOR ANNEALING STEEL WIRE UNDER VARIED HEATING PERIODS

Weight of Charge, Tons	Duration of Heating Period, Hours	Annealing Temperature, Deg. F.	Voltage	Kw. Demand	Total Kw.-Hr.	Kw.-Hr. per Ton
3.255	5	1,200	410	170	850	261
3.255	4	1,200	425	180	720	221
3.255	2½	1,200	455	200	550	169

When operating ten hours per day the furnace delivers a ton of annealed wire with a power consumption of 185 kw.-hr. When operating on a continuous 24-hour





CHARTS SHOWING TEMPERATURES MAINTAINED IN FURNACE

Curves A taken during continuous 24-hour operating. Curves B show extended soaking period.

production, a decidedly lower energy consumption per ton is effected. Results from heats on a 24-hour cycle have been as low as 115 kw.-hr. per ton of wire annealed. Under normal twenty-four-hour operation energy consumption has averaged 156.32 kw.-hr. per ton.

Because of the convenient arrangement of the furnace labor cost is very low. It is represented by the time of two men to operate the mechanical equipment for moving the cars and furnace doors and also to load and unload the cars. For twenty-four-hour operation the total labor cost for the two men, including overtime, and for other handling of material into and out of pickling vats was $1.36 per ton.

The total costs for annealing, according to Mr. Dibble, are lower than they would be with some other form of heat, and the wire annealed in this furnace has proved to be superior in quality to that obtained from fuel-fired equipment, while oxidation has been materially reduced.

The annealed wire receives from twelve to fifteen cold working operations without any further heating. Owing to the uniformity of the anneal obtained in the electric furnace, the upkeep cost on roll and die equipment has been materially reduced. In a large measure the die settings for the various cold-working operations have been standardized so that it is not necessary to change adjustments to meet variations in the temper of the wire. With the electric furnace it is assured that all the coils in a charge are annealed uniformly, whether they are taken from the bottom of the charge or from the top. With the previous combustion equipment it was frequently necessary to remove the charge before the bottom coils were fully annealed in order that the coils at the top should not be overheated. This necessitated the bottom coils being again introduced into the furnace for reheating, a procedure which was very unsatisfactory both from the standpoint of direct monetary loss and from the standpoint of plant operation.

Maintenance and repairs on the entire furnace, including the control equipment, have cost less than a hundred dollars since its installation. Mr. Lange, who has charge of the installation, states that on the furnace itself $25 would cover the cost of repairs, and the principal items on the control equipment are occasional renewals for contact points and the purchase of paper for the temperature recording chart.

Electricity on Farms Pays

So Declares Professor Stewart, Project Director, Who Presents Data to Prove Statements on Feed Grinding, Husking and Shelling, Threshing, Milking, Pumping, Hoisting Hay, Refrigeration, Incubation, Egg Laying and Milk Production

EXPERIMENTS on the Red Wing (Minn.) experimental farm line during the past two and one-half years have proved beyond doubt that the farmers can make money by using electricity, declares Prof. E. A. Stewart, project director. The benefits may be in value of labor saved, in the reduction of operating costs or the added value of products due to quality or quantity, or both. "Of course," says Professor Stewart, "if the farmer doesn't effectively utilize for other productive purposes the time saved him by electricity he isn't any better off from a dollars-and-cents standpoint by the use of electricity."

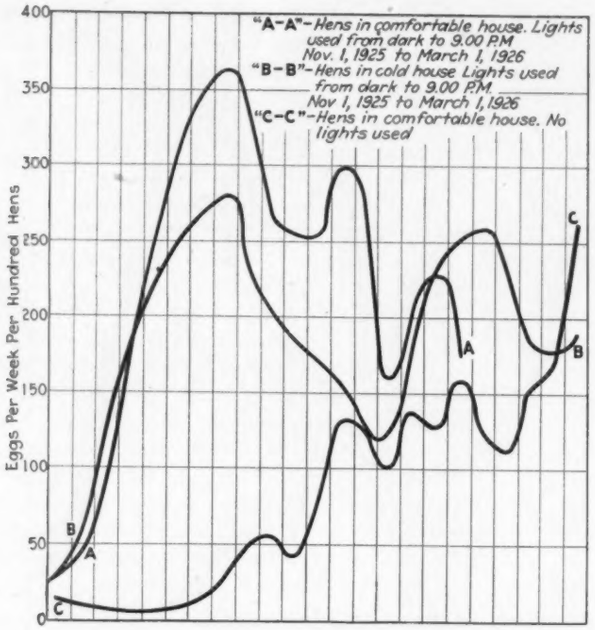
Examples of the benefits derived from electric service follow:

Feed Grinding.—Based on grinding 1,200 bushels of feed a year, W. A. Cady saved 15 cents a bushel by using electricity compared with hauling the feed to market and back and 10 cents a bushel compared with gasoline-engine grinding, making a saving of $180 and $120 over the two methods respectively. This is more than enough to pay the entire yearly electric service charge ($82.80) and is calculated on energy at 3 cents per kilowatt-hour. Hauling 50 bushels of feed to market and back required one man four hours at 30 cents per hour and $2.50 for mill charges. The expense of wagon and team is not included. Using a gas-tractor driven grinder, two men were required three hours at 30 cents per hour and 6 gal. of gasoline was used for 50 bushels. Interest on investment, depreciation, etc., on tractor and expense of team and wagon were not included. Using electricity and an electric-elevator-filled hopper, 15 kw.-hr. and one man working fifteen minutes at 30 cents an hour were required for 50 bushels.

Husking and Shelling.—Nearly $14.50 was saved on one farm in husking and shelling 400 bushels of corn with electricity compared with a gasoline engine. This saving is based on the use of a two-roll husker, formerly operated by a 6-hp. gasoline engine but finally driven by a 5-hp. motor, the latter increasing the capacity of the husker from twelve bushels per hour (fifteen bushels with very dry corn) to twenty bushels per hour due to the instantaneous overload capacity of the motor. The increased capacity was sufficient to reduce the time of husking one load from an hour and fifteen minutes to 45 minutes. On 27 loads it saved 54 man-hours. The cost of energy was 60 cents per 100 bushels. The saving in cost of fuel was $1.28, in labor $10.80, a total of $12.08. The actual saving was, of course, greater than this, as the gasoline engine costs $170 and the electric motor $140. If both machines are assumed to have a life of twenty years, the saving of this depreciation will be $2.40, making a total saving of $14.48.

Threshing.—From $10 to $20 can be saved per farm by threshing electrically, according to the experience on Mr. Cady's farm during the past year with three electric motors mounted on the separator. Energy costs for threshing vary considerably, due to the condition of the grain and straw. Average conditions give a cost of 0.76 cents per hundredweight of grain threshed. Typical costs are 23 cents per 100 bushels of succotash, 28 cents per 100 bushels of oats. Using the motors, threshing becomes a one-man job. Formerly this farmer used two men. During the 148 hours of threshing with electricity one of the men was released and enabled to earn $59.20 by working for other farmers. Another saving in labor was effected by reason of the increased capacity (15 per cent) of the motor-operated thresher.

Milking.—Through the elimination of hand labor on Mr. Cady's farm approximately $18 per month has been saved, figuring hand labor at 30 cents per hour. Hand milking on Mr. Cady's farm has been requiring about ten minutes per cow for new-milch cows and about seven minutes per cow for those in the latter half of the lactation period. Ten new-milch cows and eight strippers required an average of 160 minutes for hand milking. Since installing the milking machine, this time has been decreased to 100 minutes. The ten new-milch cows (giving 141.3 lb. of milk on test) were milked by machine in one hour, which in-



THE EFFECT OF POULTRY HOUSE LIGHTING ON EGG PRODUCTION

cludes the time for taking care of the machines. The eight strippers (producing 73.8 lb. of milk) required 53 minutes by hand. This change makes a saving of two hours per day, which if devoted to profitable production will be worth more than the electric bill for all purposes on this farm.

Slightly more than ten man-hours were required per day on B. I. Melin's farm to milk the herd by hand. Within one week after a milking machine was installed the milking time was reduced to six hours and thirty-five minutes despite the fact that two of the cows had not become accustomed to the machine and were milked by hand. This was a real saving to the farmer, as he was hiring help at $50 per month to put in the spring crop. In terms of these wages, the saving in labor amounts to $20.40 per month. The interest and depreciation on the milking machine is about $4 per month and the electricity cost about $1.80 a month. This gives a net saving of $14.60 per month in addition to the value of board saved for a hired man.

Cream Separation.—The operation of cream separators saves money in two ways. Eighteen samples of milk from three farms were tested. Ten were from motor-driven and eight from hand-driven separators. The cream loss in the motor operated was 0.023 per cent; in others 0.031 per cent. One of the farmers had about 72,000 lb. of milk last year. On this amount his cream loss would be about $2.90, and the amount of time required to separate it is about 27 hours. The motor saves the time of one man or his wife of 30 cents an hour, another saving of $8.10 in labor. The gross saving is therefore about $11, less depreciation and interest, or a net saving of $8.

Pumping Water.—A. M. Nelson saved $7.17 for fuel alone by pumping water electrically. In 1924 approximately 55 gal. of gasoline was used for water pumping, at a cost of 20 cents per gallon, or a total of $11. The first twelve months after the motor was installed 91 kw.-hr. at a cost of $2.73 was used to pump water not only for the farm, as before, but for the water system in the house. On one farm it was found that the cost of pumping water was reduced from 1.1 cents to 0.3 cent per hundred gallons by using electricity. This man pumps 60,000 gal. of water per year. During the past winter his motor did all the pumping. The year before much of it was done by hand.

Hoisting Hay.—Equipped with the proper gear ratios and a large pulley it is possible to lift the heaviest forkfuls of hay without demanding more than 4,400 watts on a 5-hp. motor. With this arrangement A. C. Bryan unloaded 116 loads of hay with an energy consumption of 0.65 kw.-hr. per ton and an energy cost of $2.25. The charge for depreciation and interest on the hay hoist is $8.80; that on the motor chargeable to this work, about 50 cents, making the total cost for unloading the hay $11.55. Professor Stewart contends that it should be possible to make hay hoists at a lower cost and thus reduce the fixed charges.

Performing this work with a horse, driven by a boy, would require about seven and a half days. The boy's wages and board would be $15 and the expense of the horse would be $18.75, making a total of $33.75, compared with $11.55 for electric operation. The availability of the boy and the horse might alter these figures.

Elevating Grain.—The cost of electricity in elevating grain on one farm was 1.4 cents per hundred bushels and on another farm 1.6 cents. Most of these farms have about 3,000 bushels of grain a year. The energy charge would be 50 cents, depreciation on equipment about $2.10, a total of $2.60. On the other farms two men did the work without electricity at a cost of not less than 50 cents per hundred bushels. The cost of hand operation was about $15. The motor-driven elevator saved about $12.40.

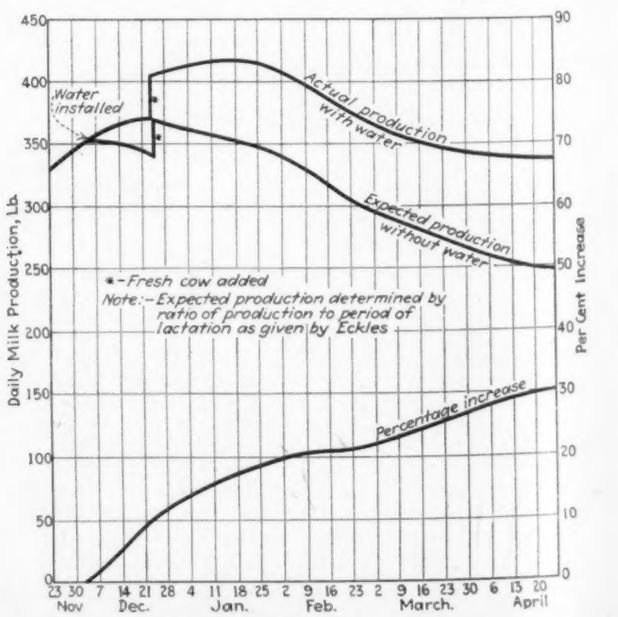
Refrigeration.—About $50 was saved last year through electric refrigeration by Frank Miller, by enabling him to secure a $67.75 bonus on sweet cream at a lower expense than with iced refrigeration. The depreciation and interest on his refrigerator were about $32; he used 228 kw.-hr. at a cost of $6.84. Ice for such purposes (as put up by one of the farmers) costs about $12 for labor. In addition, there is the cost of an ice house, sawdust and the labor of filling the refrigerator. Without placing any value on the labor used in icing the refrigerator, icing represents a cost of about $21.

Incubators.—Operating characteristics of different machines is so great that comparisons are not worth much, familiarity with the device determining to a great extent the satisfactoriness of operation. After securing expert help and becoming familiar with an electrically heated incubator, one farmer was able to raise his hatch from 27 per cent to 70 per cent on all hatches and as high as 90 per cent on one hatch. The energy consumption was 0.25 kw.-hr. per egg set, or 0.75 cent per egg.

Custom hatching and sale of chicks netted one farmer $138, or more than enough to pay his electric bills for a year.

Mr. Lokkesmoe with a 2,700-egg electric incubator turned out one hatch at a cost of 10 cents per chick, compared with 17 cents for eggs hatched away from home. On a basis of 5,000 chicks, which he expects to hatch, this represents about $350, or more than 50 per cent of the cost of the incubator.

Lighting the Poultry House.—On Mr. Lokkesmoe's farm, where a pen of 106 hens is used as a check pen, the egg production per hen without light during March was 11.9, whereas that with light was 15.9 eggs. The increase in egg production was 225 doz., which at an average price of 32 cents per dozen gave an added income of $87 per month; electricity for the lighting cost $3.12. On three other farms—one without poultry-house lighting and the other two with it—the egg production per hen in the unlighted



DRINKING CUPS (MADE POSSIBLE BY ELECTRIC PUMPING) INCREASE MILK PRODUCTION

house was 5.3 eggs per hen, whereas that in the two lighted houses was 24.4 and 32.3 eggs per hen respectively during November, December and January.

Value of Electric Pumping.—When electricity is available for pumping, water can be made available for drinking cups in the dairy barn. In Mr. Cady's barn, where drinking cups are installed for horses, calves and cows, the increase in milk yield from Dec. 5 (when the cups were installed) until April 24 amounted to 8,500 lb. Besides, approximately 340 lb. additional butter fat was secured. At an average price of 45 cents per pound of butter fat an additional $153 has been obtained because of the water system.

Letters from Our Readers

Allocation of Capacity Costs

To the Editor of the ELECTRICAL WORLD:

In A. S. Knight's letter to the ELECTRICAL WORLD, published in the issue for July 31, the writer's methods for allocating capacity costs are discussed and "assailed." Mr. Knight makes the following statement in the second paragraph of his letter: "If his [Greene's] theories were unassailable, it would perhaps be a very great improvement over the demand method." If he had said, "If his [Greene's] theories were unassailable by relevant facts, it would be a very great improvement over the demand method," the writer would subscribe to every statement contained in the first two paragraphs of Mr. Knight's letter.

Mr. Knight lays down the general principle that rates and costs are not the same thing. The writer accepts this as a fundamental principle and a fact. Mr. Knight, however, raises several objections to the use of the "theories" for cost allocation because the results do not support consistently some existing rates and may not give costs that will harmonize with the costs of some prospective isolated-plant customer or warrant the securing of certain business for an amount less than costs allocated by the "theories." Can these objections have any bearing on the question since they assume that costs and rates are synonymous? If a system of cost allocation that will support every existing rate, or any greatly desired rate, is a requisite, does not cost allocation become a mere farce? How can cost allocation *per se* affect rates? The information gained by the allocation of costs might create a desire to change rates, and if generally adopted, may ultimately result in rate adjustments, but what bearing does it have on the sufficiency of the "theories" for the allocation of capacity costs?

The statement that a customer might be profitable if taken at a rate below average cost but in excess of increment costs is unquestionably true, but is it a relevant fact? It is not the function of the "theories" to determine the capacity costs, but to allocate them after they have been determined. The use of the "theories" will prevent no utility from setting up two or more classes of customers as follows: (1) Those charged with the capacity costs of one year; (2) those charged with the increment capacity costs of the next year; (3) those charged with the increment capacity costs of the third year, etc., ad infinitum. Such a classification may utterly disregard the "community of interests" principle and may be impracticable in attainment, but, if resorted to, the "theories" would be applicable to the allocation of the capacity costs of each such class to the consumers of each class.

Mr. Knight admits that a 100-per-cent-load-factor customer would be served at less than cost if the unit cost obtained by the demand method of allocation be used as the rate, but tries to minimize the dangerous effects that might result. Does Mr. Knight not condemn the demand method by this admission of its inaccuracy?

Mr. Knight states that "if diversity factor were inversely proportional to load factors, the 'theories' would give a more accurate allocation of costs than would the demand method." If such were always the case, could not capacity costs be allocated with accuracy by the method which follows? "Multiply the system's unit capacity cost by each consumer's maximum demand and divide each such product by the reciprocal of each respective consumer's load factor. The result will be each consumer's allocated capacity costs." The application of the above method to the data used in my article of May 29 results in a recovery of only $538.57 from the ten consumers. The potential diversity of the group is a trifle over four, the actual diversity three. The only customer to whom is given the same cost as is determined by the "theories" is the 100-per-cent-load-factor consumer. Is not the fact that diversity does not vary inversely as load factor the reason for some method that will accurately measure the effect of the difference between potential and actual diversity?

The writer agrees with Mr. Knight in the statement that no definite and uniform relation exists between load factor and diversity factor, but disagrees with him in the conclusion that such a relation is necessary in order to substantiate the claim that the unit demand cost of a high-load-factor consumer of a system is more than the unit demand cost for the average load factor of the system and that the unit demand cost of a low-load-factor consumer is less than the unit demand cost of the average load factor of the system.

Mr. Knight concludes that, in view of all his arguments, he feels obliged to disagree with the "theories" as furnishing an accurate method for the division of capacity costs among consumers, and that the plan seems to him "merely an ingenious mathematical compromise between allocating capacity costs upon the demand method and upon the straight-meter method." All other methods thus far publicly advanced for the allocation of capacity costs have been proved inaccurate under certain conditions, but the "theories" have not been proved inaccurate under any conditions; consequently should they not be accepted as reasonably accurate mathematical combinations of the demand and kilowatt-hour methods, instead of compromises, until it can be proved that some other method is more accurate?

W. J. GREENE,
Rate Engineer.
Iowa Railway & Light Corporation,
Cedar Rapids, Iowa.

Hydro-Electric Development in India

THE Mysore and Bombay hydro-electric projects have increased interest in various parts of India regarding greater development of hydro-electric power, according to a report from Vice-Consul Robert L. Buell, Calcutta, India, made public by the Department of Commerce. A survey of the Punjab and the adjoining native states has disclosed a potential supply of nearly 2,500,000 hp., most of which is capable of economical development. The official program outlined for the Punjab foreshadows the ultimate completion of a system of electric power transmission lines extending from Peshawar, in the northwestern part of India, to Delhi, the Consul states.

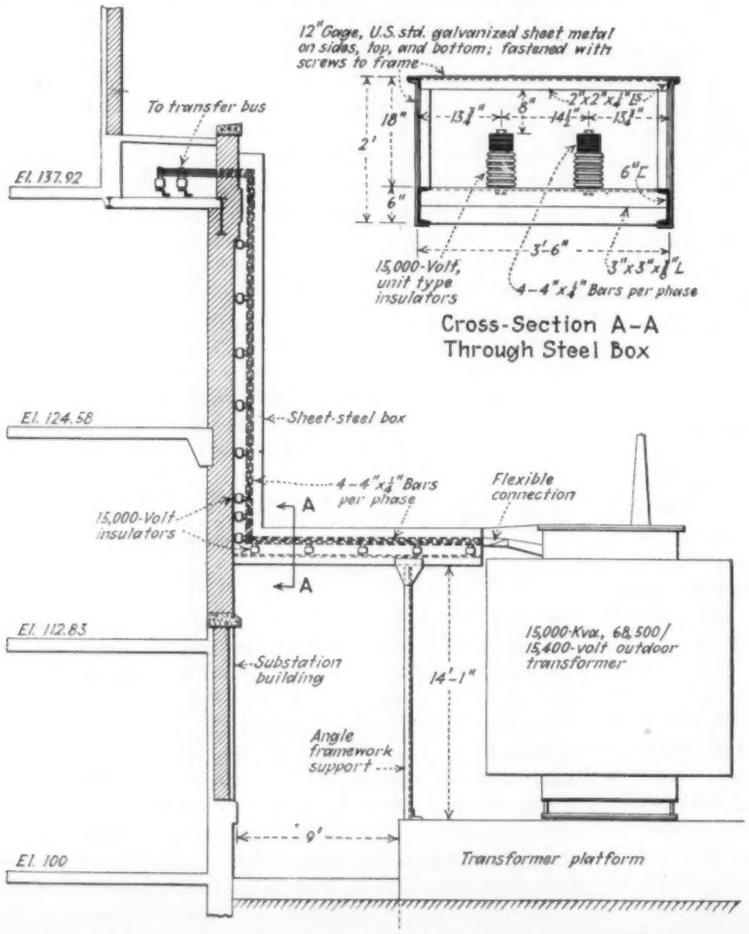
Central Station and Industrial Practice

Inverted Metal Trough Protects 13-Kv. Bare Leads

OUTDOOR equipment is sometimes connected with indoor equipment by elevated insulated cable or conduit, by underground conduit or by subway construction with bare buses, each form having its advantages and disadvantages.

At several of the combined outdoor-indoor substations of the Northern States Power Company the 13.2-kv. terminals of the outdoor transformers are connected with the indoor circuit breakers by bare copper bars collectively housed in an inverted metal trough protecting the buses and workmen from accidental short circuit. Where there is a tendency for birds to nest beneath these troughs, the bottoms can be closed, although it has not been found necessary to do so.

When the copper conductors are long enough to require intermediate supports, a simple elevated steel structure serves this purpose as well as the attachment for inverted metal trough. In other cases a light metal support holds the trough in position. Between the buses are insulating spacers which prevent distortion of the bars during excessive currents.



BARE COPPER 13-KV. LEADS FROM TRANSFORMERS HOUSED UNDER METAL COVERINGS

Conjectures and Speculations

ATMOSPHERIC ELECTRICITY

BY C. L. KASSON
Edison Electric Illuminating Company of Boston

A LIGHTNING stroke is electrical rupture of air. It takes place from a cloud to earth because an excessive potential difference exists. Therefore:

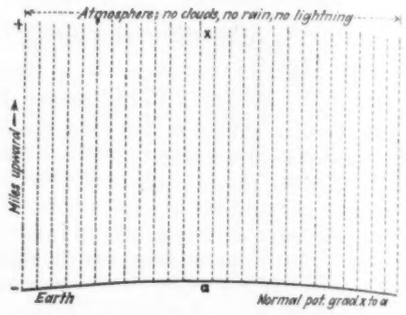
A. There must be electric energy in the cloud previous to the stroke.

1. This energy is concentrated and at a high potential.

a. The concentration is due to the gathering together of the distributed electric energy.

b. The high potential is due to the concentrated vertical potential gradient.

B. There must be electric energy



NORMAL POTENTIAL DISTRIBUTION IN ATMOSPHERE ABOVE THE EARTH

in the atmosphere at all times. Under normal conditions the energy content is uniformly distributed in planes parallel to the earth's surface. Under normal conditions there must be a uniform potential gradient from points above the earth to the earth in a direction perpendicular to the earth's surface.

1. The uniform condition is a balanced condition, a cloudless sky.

2. The non-uniform condition is an unbalanced condition and varies all the way from the slightly cloudy to the thunderstorm, etc. In the latter condition the energy is concentrated in the cloud and the potential gradient from the cloud to earth in the vertical plane is very high.

C. The electric energy in the atmosphere is due to the sun. Energy, which is electricity broadcast, so to speak, by the sun, traversing the atmosphere produces a uniform potential gradient perpendicular to the earth and a uniform energy content per unit of air in a horizontal plane under normal conditions.

1. This uniform energy content is manifest to us humans through our senses as light and heat.

a. Whether it is light or heat depends upon the mediums (the matter) through which it travels.

b. Electric energy through air, in right distribution, is manifest as light.

c. Electric energy through liquid or solid matter is manifest as heat.

D. All things are relative; thus in

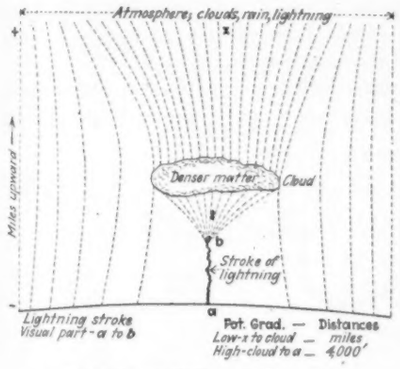
all matter, whether gaseous, liquid or solid, energy manifests itself to us through the senses as light and heat in varying degrees, depending upon the matter, its kind, condition and form. The range extends from maximum heat with minimum light to maximum light with minimum heat.

1. With given energy, as solar energy, the denser the medium the greater the heat, the less dense the greater the light; as the surface of earth to its interior, increasing temperature.

2. With given energy, as solar energy, the rarer the medium the greater the light and less the heat; as the surface of the earth outward and upward through the atmospheric belt, decreasing temperature and increasing light.

E. The cloud is denser matter in the atmosphere; its energy content and potential gradient are greater than normal.

1. Clouds are finely suspended moisture driven by the wind. The



EFFECT OF CLOUD ON POTENTIAL DISTRIBUTION

wind thus forms clouds. The wind is due to differences of temperature.

2. Differences and action of wind and cloud are due to temperature gradient, unbalanced heat conditions, on the earth.

F. Clouds are moisture derived from bodies of water on the earth by solar action. This again is a question of temperature. Thus the cloud, its formation, its destination and concentration depend upon temperature conditions, depend upon the heat balance.

1. A cloud spills its moisture (matter) and there is rain.

2. A cloud discharges its solar energy and there is lightning.

G. Rain and lightning thus depend upon the heat balance. Under absolutely balanced conditions there would be no rain and no lightning. What causes the unbalance? What holds the heat balance?

Carrier Communication at High Radio Frequencies

By L. A. Terven
Radio Engineer West Penn Power Company

THE frequencies used by power companies for carrier current communication are usually on the order of 40 to 100 kc. The West Penn Power Company has discovered a very marked carrier effect when using space radio communication employing a frequency of 2,100 kc.

Two radio stations are in commercial operation, but they are used solely for emergency operation in case of a failure of physical communication channels. The rating of the stations is 100 watts output each and voice modulation is used instead of code. As the distance between stations is 30 miles, the audibility of signals in the summer months during the daytime is very poor when a receiving antenna is used so located in the substation that considerable interference is experienced from the local electrical equipment.

In the effort to improve the signal level experiments were conducted, and it was found that the audibility under a 66-kv. transmission line was about 250 times as great as when the receiving antenna was located 200 ft. away from the transmission lines. A tent was erected under the 66-kv. line as shown in Fig. 1 and reception was very good. Furthermore, no adjustments of the receiver were necessary for atmospheric variations during the day and night.

The object of the radio stations being to guarantee load dispatching even should the transmission lines break, it was decided to cut the two 66-kv. lines near the middle of the

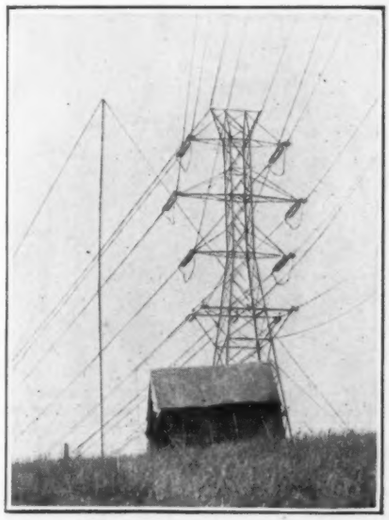


FIG. 1—RECEIVING ANTENNA CONNECTED TO A 66-KV. TRANSMISSION LINE

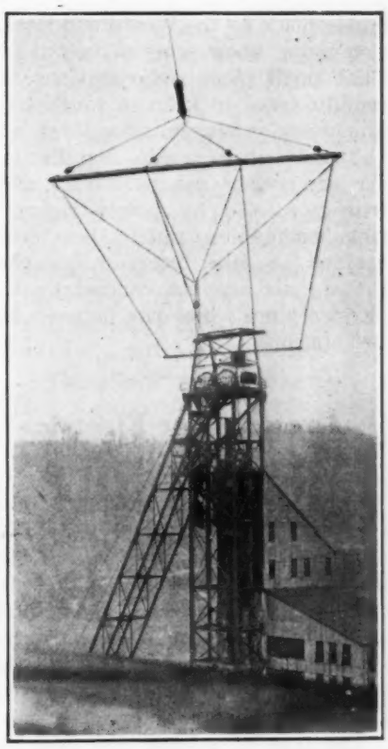


FIG. 2 — TRANSMITTING ANTENNA AT SPRINGDALE POWER STATION OF THE WEST PENN POWER COMPANY

30-mile distance to see if the signals would still be audible. The conditions were made progressively more difficult according to the following schedule: The lines were switched out of service, then grounded at each end (Springdale and Charleroi). Next the lines were grounded at the middle point near the Lincoln Highway. Then the lines were opened at a tower near the highway and the ends of the line toward the transmitter (Springdale) left ungrounded. It was intended to ground the telephone line that runs under the power conductors, but the progress of the test left this additional factor unnecessary.

Reception became weaker and weaker as the different steps of the interruption were taken. When the transmission lines were actually cut at the highway, reception became so poor that signals were received with great difficulty. A receiver located near the highway separation point picked up strong signals under all conditions of the test.

The transmitting antenna at Springdale is shown in Fig. 2. No attempt is made to couple it to the outgoing transmission lines, and the building, of steel and concrete construction, is between the antenna and the high-tension switchyard.

In general the tests, along with

others made by the West Penn Power Company, show conclusively: (a) That small space radio stations can readily serve to keep in touch with line crews on transmission lines, and (b) that space radio installations for emergency use be looked upon with suspicion by power-transmitting companies until they have verified by line interruptions that the signals are not carried by the physical lines which run between the two stations.

Grounds for Electric Circuits

METHODS of grounding different equipment and testing to ascertain whether a satisfactory ground exists have become of increased significance. Two methods of grounding secondaries, lightning arresters and transformers used by the Milwaukee Electric Railway & Light Company are shown.

The type of ground rod used for secondaries and lightning arresters on the distribution system is represented in Fig. 1. Where transformers and lightning arresters are mounted on the same pole, the lightning arresters are grounded separately at the pole upon which they are mounted. The neutral of the transformer is grounded on one span away from the pole upon which the transformer is mounted. The type of ground connection is the same in both cases. In cities waterpipes are used for grounds.

For temporarily grounding circuits, to protect linemen or other workmen the equipment shown in Fig. 2 is used. When using this equipment, the ground connection is made first and then the chain is pulled over the conductors by means of a rope so that if by accident the conductors may be alive they will be grounded through the chain when it is applied and not injure the workmen. After thoroughly grounding conductors with a chain, the short-circuiting jumper must be applied by hand as an added or more reliable safety device.

The device for measuring the resistance of grounds was explained and diagrammed in a short article appearing in the ELECTRICAL WORLD of May 23, 1925, on page 1081.

The foregoing information was furnished by G. G. Post, electrical engineer of the Milwaukee Electric Railway & Light Company.

Industrial Electric Control in Steel Mills

BY N. L. MORTENSEN
Assistant Chief Engineer
Cutler-Hammer Manufacturing Company,
Milwaukee, Wis.

ALTHOUGH automatic skip hoists, bell hoists, furnace-top equipments, etc., have been in operation in steel mill and blast furnace plants for a number of years, it is only recently that automatic gage-rod operation has been installed and all of the different motions interlocked through the control equipments, so that the complete installation can be considered a one-man charging arrangement. That is, by moving a control lever, the skip bucket and load will be hoisted, the load charged into the hopper, the hopper rotated, the little bell dumped, and after a predetermined number of loads have been dumped by the little bell, the large bell will be operated. The gage-rod controller is so interlocked with the skip-hoist con-

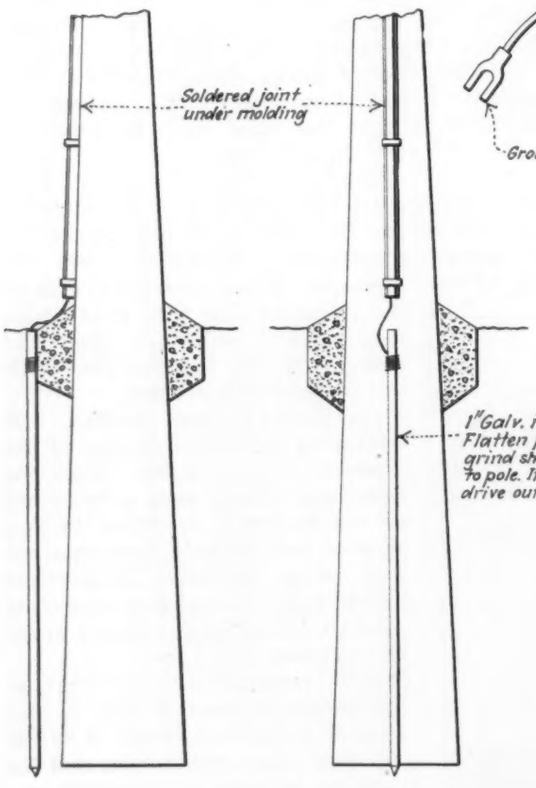


FIG. 1 (AT LEFT)—GROUND ROD FOR SECONDARIES AND LIGHTNING ARRESTERS. (SEE NOTE.)

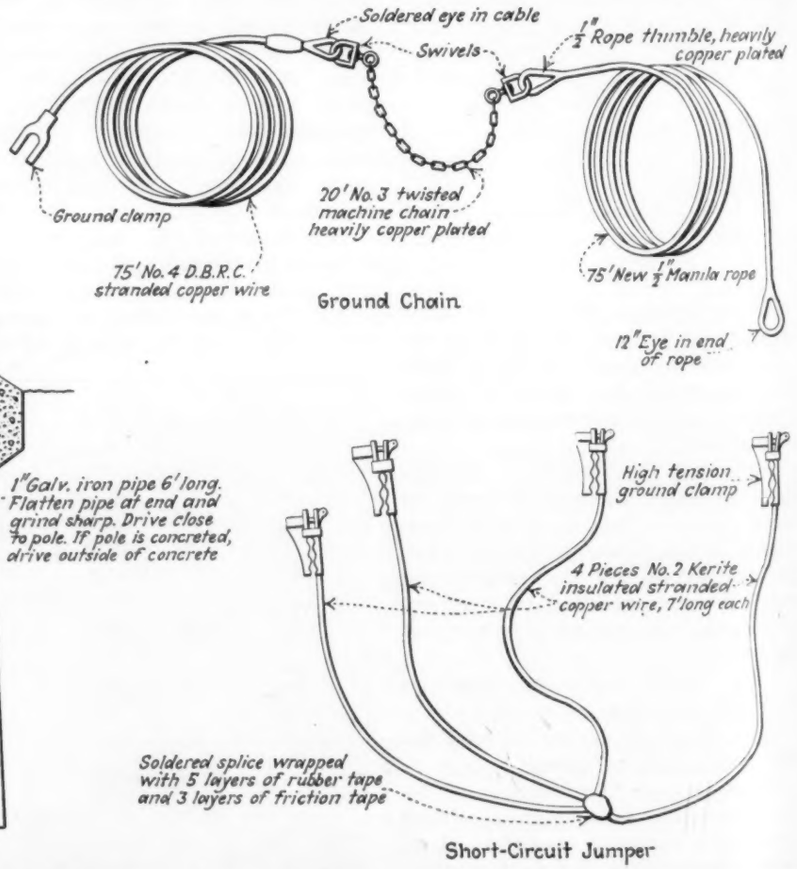
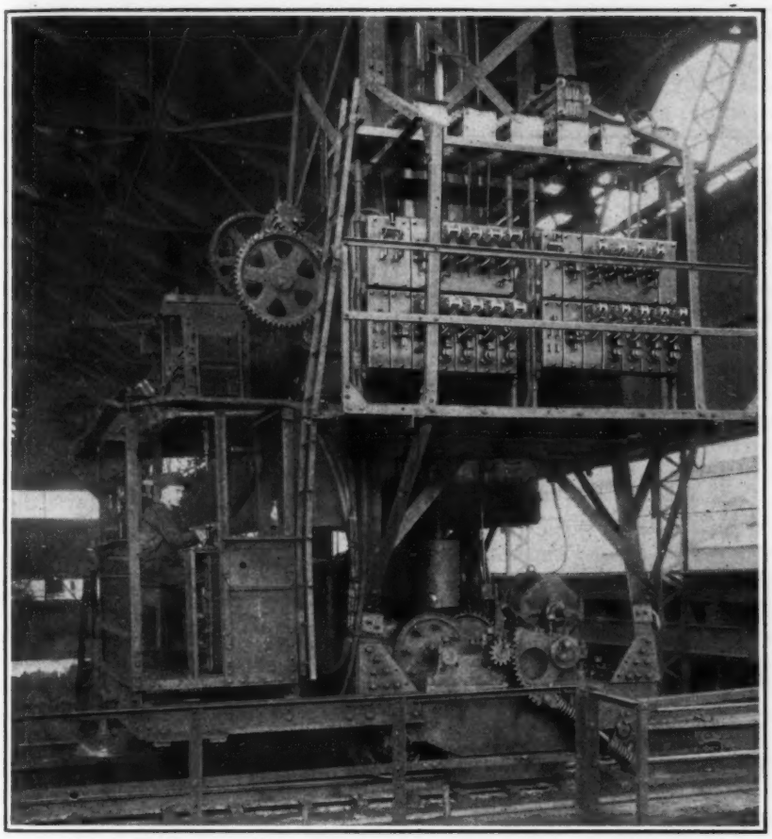

Soldered eye in cable
Swivels
1" Rope thimble, heavily copper plated
Ground clamp
20' No. 3 twisted machine chain heavily copper plated
75' No. 4 D.B.R.C. stranded copper wire
Ground Chain
75' New 1" Manila rope
12" Eye in end of rope
1" Galv. iron pipe 6' long. Flatten pipe at end and grind sharp. Drive close to pole. If pole is concreted, drive outside of concrete
High tension ground clamp
4 Pieces No. 2 Kerite insulated stranded copper wire, 7' long each
Soldered splice wrapped with 5 layers of rubber tape and 3 layers of friction tape
Short-Circuit Jumper

FIG. 2 (AT RIGHT)—GROUND CHAIN AND JUMPER FOR PROTECTING LINEMEN AND WORKMEN

Note—Attach 48 in. of No. 6 W.P. wire to ground pipe in shop. Skin back one end 5 in. for splicing and other end 25 in. and pass through No. 15 drilled hole 5 in. from end, making five turns around pipe.



INDUCTIVE TIME-LIMIT CONTROL ON SOAKING PIT CRANE

troller that the load will not be hoisted if the furnace is full. Automatic operation reduces the operating time to a minimum, as each machine will function as soon as the preceding one stops. It also removes the uncertainty of the human element.

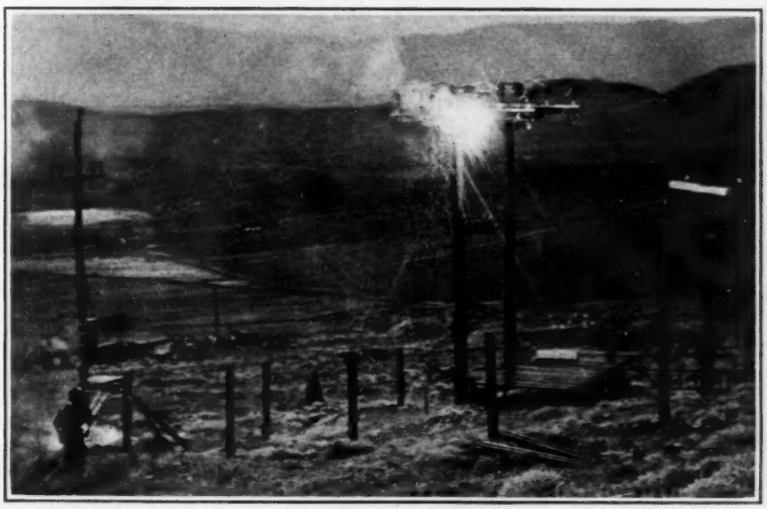
Electric drives for the rolling-mill process is an old-established practice, and the main control development in connection with them lies in the application and design of equipment with time-limit acceleration for auxiliary drives. When electric motors were first installed for auxiliary drives in steel mills, the main requirement was protection for the motors, and current-limit control was practically exclusively used. This system of control is still satisfactory where there is little variation in load conditions. However, it must be adjusted to accelerate the heaviest load. The maximum load generally occurs in steel mill practice when the mill is cold; after it has been in operation for some time, the load is reduced.

Improvements in motor design and experience in application have made it possible to choose motors that will satisfactorily operate the mill under normal conditions, and only under emergency conditions is any protection required. This has changed the requirement of the controllers so that they can now be designed to make the motor perform specific duties necessary to meet requirements and operating schedules of the mill in general and in addition protect the motor under exceptional conditions. This has led to the requirement for time-limit control, where the operating schedule of the mill can be maintained regardless of load conditions. Furthermore, time-limit control makes the motor respond directly to the master handle. Consequently the operators can synchronize their movements accordingly and carry out their duties more automatically than can be done where current-limit control is used.

Time-limit control has been used for some years, but has generally been supplied with some sort of a dashpot to obtain the time delay. Recently control equipments have been developed in which time delay is obtained by magnetic and inductive principle instead of the dashpot. With this type of controller greater simplicity and reliability are obtained. Controllers of this type have been used with great success on auxiliary drives as well as on a number of crane installations, such as charging cranes and soaking-pit cranes, where fast operation and simplicity are at a premium.

Another recent development in control is the interlocking system used in connection with the different control equipments operating the motors for the auxiliary drives, enabling the operator to handle more machines for different motions with greater ease. This interlocking of control has made it possible to eliminate operators throughout the mill.

Lightning Striking a 65,000-Volt Power Line



HEREWITH is an unusual illustration from a photograph taken during an electrical storm in which lightning struck a 65,000-volt power line, melting in two one of the wires near the lightning arrester. It so happened that Louis Gordon, son of L. D. Gordon, general manager and president of the New Candelaria Mines Company, which owns the line, was near when the conductor broke. The illustration shows young Gordon dodging the live wire which struck the ground less than five feet behind him. No injuries.

Commercial Activities and Public Relations

Range-Selling Campaign of the Washington Water Power Company

BY EDWARD E. SCOFIELD
Spokane, Wash.

DURING a special campaign conducted from June 21 to July 31, 1926, the Washington Water Power Company sold 309 Westinghouse electric ranges and water heaters over its system, representing gross sales of about $50,000. This was the second range campaign conducted this year. Of the 309 ranges sold, 214 were installed in the city of Spokane and 95 in the outside territory.

The campaign featured the Westinghouse junior cabinet model, although other models were also sold. Of the total sales, 221 were junior cabinets. The only special sales feature was the reduction of the down payment to $4.75. The ordinary selling policy of the Washington Water Power Company was used, whereby in the city the regular salesmen worked on a 10 per cent commission basis, with special prizes for the greatest number of sales during each week and during the entire campaign. J. R. Wiedeman was highest city salesman with 26 ranges to his credit and M. E. Collins was second with 23 ranges. The plans and policies were outlined for the city work by Lewis A. Lewis, sales manager, and R. B. McElroy, assistant sales manager, and those of the outside territory were under the direction of J. F. Farquhar, general agent.

It is estimated that these ranges will bring the company a gross revenue of about $25,000 per year and increase the total number of ranges on the company's system to nearly 8,000.

Selling More than Merchandise

THE Porto Rico Railway, Light & Power Company uses a means for reiterating its willingness to serve that might profitably be copied by other companies in the United States.

On every electrical device or household appliance sold by this company there is attached a tag bearing a notice regarding the service of the company. On one side the notice is in English and on the other in Spanish. The notice reads: "If any trouble is experienced with the operation of your electrical equipment, please call San Juan 163. On Saturday afternoons and holidays call Santurce 310. We will appreciate your reporting to the general office any complaints regarding electric service which are not promptly rectified to your satisfaction."

The customer who buys an electric iron or toaster or whatnot with this tag attached to it carries away with his purchase not only the ponderable merchandise but also the conviction that the company is anxious to assume the burden of keeping that particular appliance in perfect working order. It is the aim of every merchandiser, worthy of the name, whether he sells electrical goods or any other commodity, to deliver to the customer along with the particular object of the sale a feeling that the buyer is receiving more than the tangible thing for which he has paid his money. This tangible addendum to the purchase is the conviction on the part of the customer that he will receive willing service from the seller.

Electrified Dairy Operating Costs

THROUGH the co-operation of the San Joaquin Light & Power Corporation and L. J. Christie, owner of a completely electrified dairy in the San Joaquin Valley, California, some interesting figures have been obtained on the operating costs of the electrical equipment. This information is presented in the accompanying tables. In Table I will be found kilowatt-hour consumption and bill for all electrical apparatus with the exception of an irrigation pump and a feed chopper. Table II gives the same data for these latter two motors.

Two electric ranges are used on the farm, one in the foreman's residence and the other in the cookhouse

TABLE I — KILOWATT-HOURS USED AND BILL FOR LIGHTING, COOKING AND MISCELLANEOUS POWER ON COMPLETELY ELECTRIFIED DAIRY

Connected Load

Two 7-kw. electric ranges.
Two 5-kw. water heaters.
One 5-kw. sterilizer.
One 2-hp. motor on milking machine.
One 3-hp. motor for domestic water supply.
Approximately 5 kw. in lighting in residence, cookhouse, barn and milking shed.
Monthly minimum—$25.50

Month	Days	Kw.-Hr.	Bill
July	13	....	....
August	29	2,904	$48.51
September	30	3,288	54.27
October	31	3,144	52.11
November	32	3,504	57.51
December	25	2,736	45.99
Total	160	15,576	$258.39

Average kilowatt-hours per day, 97.35.
Average rate earned, $0.0166 per kilowatt-hour.

TABLE II—KILOWATT-HOURS AND BILL FOR IRRIGATION PUMPING AND FEED CHOPPER ON ELECTRIFIED DAIRY

Connected Load

Pump, 20 hp. Feed chopper, 30 hp.

Month	Days	Kw.-Hr.	Bill
July	13	7,320	$139.29
August	29	12,432	211.55
September	30	9,648	172.57
October	31	3,432	85.55
November	32	2,664	35.96
December	25	1,872	25.27
Total	160	37,386	$670.19

Average kilowatt-hours per day, 234.
Average rate earned on pumping plant for season, $0.0174 per kilowatt-hour.

TABLE III—RESIDENCE

7-kw. range. 5-kw. water heater.

Month	Days	Kw.-Hr.	Bil
July	13	1	....
August	29	271	$4.50
September	30	328	5.45
October	31	291	4.83
November	32	409	6.79
December	25	389	6.46
Total	160	1,689	$28.03

Average kilowatt-hours per day, 10.5
Average rate per kilowatt-hour, $0.0166 (Table I

TABLE IV—COOKHOUSE

7 kw. range. 5 kw. water heater.

Month	Days	Kw.-Hr.	Bill
July	13	509	$8.45
August	29	1,159	19.24
September	30	1,199	19.90
October	31	1,192	19.79
November	32	1,368	22.70
December	25	1,064	17.66
Total	160	6,491	$107.74

Average kilowatt-hours per day, 40.5.
Average rate per kilowatt-hour $0.0166 (Table I).

TABLE V—STERILIZER

Five kilowatts

Month	Days	Kw.-Hr.	Bill
July	13	318	$5.08
August	29	662	10.98
September	30	831	13.79
October	31	831	13.79
November	32	894	14.84
December	25	634	10.52
Total	160	4,170	$69.00

Average kilowatt-hours per day, 26.
Average rate per kilowatt-hour, $0.166 Table I).

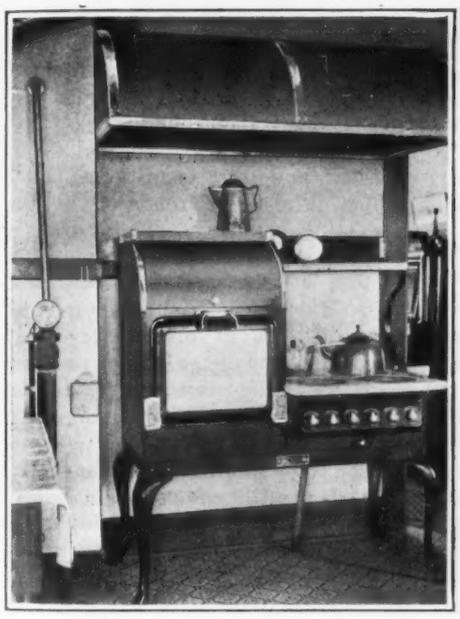
TABLE VI—MILKING SHED LIGHTS AND FAN

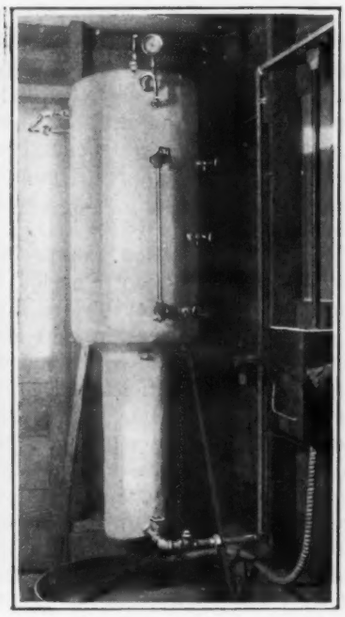
Month	Days	Kw.-Hr.	Bill
July	13	17	$0.28
August	29	31	.51
September	30	46	.77
October	31	42	.69
November	32	51	.85
December	25	29	.48
Total	160	216	$3.58

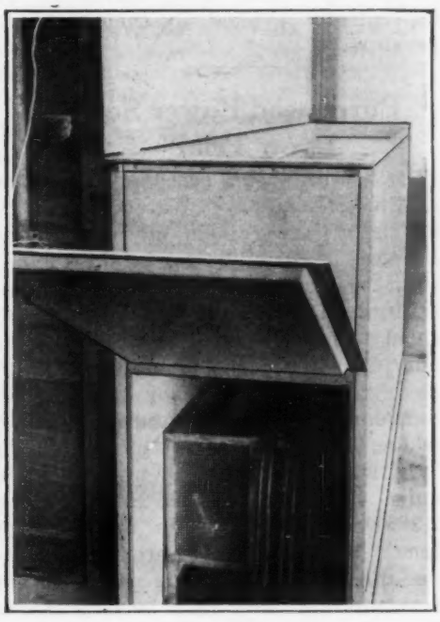
Average killowatt-hours per day, 1.35
Average rate per killowatt-hour, $0.0166 (Table I).

where the farm hands are fed. The average number of individual meals cooked per day on both ranges during the period covered in Tables III and IV was 24, making the average cost for current 3.5 mills per meal. The use of an electric sterilizer for dairy utensils has proved very satisfactory at this and other California dairies, and the very nominal cost of operation is shown in Table V. The sterilizer has a capacity of eight milk cans, with a lower compartment sufficiently large to hold all parts of the milking machine and the parts of the separator to be sterilized. Electric milking costs for a herd of 80 cows milked twice a day are shown in Table VII. One very useful electrical appliance is a ceiling fan near the entrance to the milking shed which keeps flies from entering the milk house. The cost of operating this fan together with lights in the milking shed and milk house is shown in Table VI. During the period of operation of the 30-hp. feed chopper covered in Table X approximately 1,500 tons of hay and 550 tons of ensilage were chopped. This makes the average cost per ton for power 22.6 cents.

Mr. Christie, owner of the ranch, is enthusiastic over his electrical equipment and states that from his experience the "electrical" way is the only way to operate a dairy ranch.







ELECTRICAL EQUIPMENT INSTALLED IN A CALIFORNIA DAIRY FARM

At left, electric range and water heater installation. In center, lagged water tank with 5-kw. heater. At right, sterilizing compartment having capacity for eight milk cans as well as milking machine and separator parts

TABLE VII—2-HP. MILKING MACHINE

Month	Days	Kw.-Hr.	Bill
July	13	100	$1.66
August	29	166	2.65
September	30	189	3.14
October	31	195	3.24
November	32	231	3.83
December	25	170	2.82
Total	160	1,051	$17.34

Average kilowatt-hours per day, 6.8
Average rate per kilowatt-hour, $0.166 (Table I).

TABLE VIII—PRESSURE SYSTEM, 3 HP.

Month	Days	Kw.-Hr.	Bill
July	13	150	$2.49
August	29	438	7.27
September	30	451	7.48
October	31	356	5.91
November	32	283	4.69
December	25	195	3.23
Total	160	1,873	$31.07

Average kilowatt-hours per day, 17.
Average rate per kilowatt-hour, $0.0166 (Table I).

TABLE IX—BARN LIGHTS

Month	Days	Kw.-Hr.	Bill
July	13	7	$0.12
August	29	15	.25
September	30	17	.28
October	31	18	.30
November	32	11	.18
December	25	12	.20
Total	160	80	$1.33

Average kilowatt-hours per day, 0.5
Average rate per kilowatt-hour, $0.0166 (Table I).

TABLE X—30-HP. FEED CHOPPER

Month	Days	Kw.-Hr.	Bill
July	13	440	$7.65
August	29	960	16.70
September	30	160	2.78
October	31	330	5.74
November	32	470	8.18
December	25	300	5.22
Total	160	2,660	$46.27

Average kilowatt-hours per day, 16.6
Average rate per kilowatt-hours, $0.0174 (Table I).

Electric Heat in Petroleum Industry

THE use of electric heat in processing a byproduct in the cracking of California petroleums is considered in the West as the opening of a new field for this type of heat. The Union Oil Company has installed a grease kettle in its Oleum (Cal.) plant, in which the proper temperature is secured by electric heating units.

The load in the kettle consists of mineral oil, caustic soda and stearic acid mixed in proper proportions to make up approximately 150 gal. This is maintained at a temperature of approximately 350 deg. F. for a period of about eight hours and is agitated by means of motor-driven paddles.

Fourteen 3.8-kw. heating units are arranged in three zones around the bottom of the kettle, four of which are used as external resistance that can be cut in or out to obtain varying amounts of heat to change the temperature of the grease as required. The insulation consists of two sheets of half-inch transite sep-

arated by approximately 4 in. of insulating powder. By means of a watt-hour meter a close check is obtained on the amount of energy required to make a run. Three control switches and a disconnecting switch are used for controlling the heat. The heating units and other electrical equipment were furnished by the General Electric Company.

One of the reasons electric heat is attracting such attention in this field is the fact that a new grease is now being made that requires in its processing the comparatively high temperature of 350 deg. F., and steam, heretofore used, cannot be conveniently applied to that temperature.

Purchased Power Sold on Trial

FOR several years past the Central City (Kentucky) Water Works has been served from oil engines. Because of inability to obtain the actual operating costs with oil, the utility solicited the city's business chiefly on the basis of convenience and ample capacity requirements, basing the oil and labor costs of pumping on statistics secured elsewhere.

It was found that it would require one and one-half miles of 2,300-volt lines to reach this customer and that on approximately one-third of this line some rural residential business could be secured. Therefore the Central City Water Works was approached with the utility offer to build this line at the utility's expense as a trial installation. The only requirement was that the city would sign a 30-day contract with the privilege of cancellation at the end of any 30-day period during the first twelve months. If at the end of the first twelve-month period the cost of operation with purchased power had not exceeded the estimated cost a regular-term contract was to be signed. If during the initial twelve-month period the city desired to cancel the trial installation, it could do so by paying 50 per cent of that portion of the line costs which had been incurred purely for the purpose of serving the pumping station.

This pumping plant has now been served eight months at an average monthly cost of $780 for an average monthly consumption of 14,000 kw.-hr., according to L. W. McLellen, commercial manager of the Kentucky Utilities Company. The electric drive consists of one 100-hp. motor direct connected to a 750-g.p.m. pump. The previous installation consisted of a 200-hp. oil engine belted to a 1,080-gal. centrifugal pump operating against a pumping pressure of 200 lb. with a static head of 90 lb.

Under oil operation the previous cost for a twelve-month period had averaged $645.30 monthly, exclusive of interest, depreciation and innumerable items of cost not included in this amount. Furthermore, during that period frequent interruptions had been experienced, some time having passed since the pumping combination had operated a full month without shutdown for repairs.

Now the capacity requirements and labor problems are considered solved. These advantages, together with the convenience, have proved that it has effected a material saving.

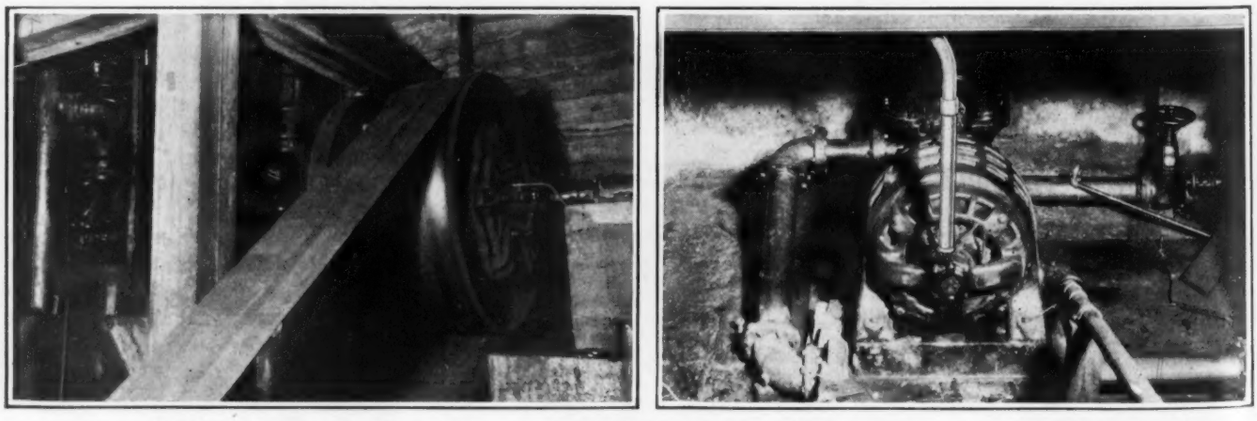
Insull Viewpoint on Holding Company Regulation

COMMENTING on the public misunderstanding regarding the relation of electric light and power holding companies—or investment companies, as he designates them—and their financial structures to the rates charged for service, Martin J. Insull, president of the Middle West Utilities Company, had the following to say recently:

"The public should understand that the investment companies cannot affect the rates the public pays for electric light and power service any more than any other form of ownership. The public's rate is based on the value of the physical property used and useful for the public service, irrespective of where the ownership of the property may rest. Whether an investment company is interested in the securities of the operating company or not, the operating company can still issue only such securities as the state regulatory body allows it to issue. That body also prescribes the class of service and the conditions under which it shall be rendered by the operating company. Therefore the public is fully protected in the regulation of the operating company. In so far as the public interest is concerned, it is unnecessary that anything beyond the operating company should be subject to regulation.

"On the other hand, it cannot be expected that the public, without reason to be familiar with the fundamentals of utility financing, can hear of high prices being paid for operating properties and not feel that in some way it is affected. This feeling has foundation for that portion of the public that may invest in securities growing out of such purchases, but it is wholly groundless from the standpoint of the strictly consuming public.

"The fact that many of the outstanding operating companies supplying efficient service are largely controlled by investment companies is significant."



COMPARATIVE SPACE REQUIREMENTS OF THE FORMER OIL ENGINE-DRIVEN PUMP AND THE PRESENT MOTOR-DRIVEN PUMP AT CENTRAL CITY, KY.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Selection of Fuel-Burning Equipment for Generating Stations.—G. W. KEEN.—The two principal things to be considered when making a choice of fuel-burning equipment, as seen by the author, are reliability and economy. He compares the two systems on the basis of economy to determine the more favorable one and then to decide whether or not the reliability features of that system are satisfactory. Station load, size of station, the ash question and the grade of coal readily obtainable are other factors that receive consideration in this paper.—*Mechanical Engineering Journal*, September, 1926.

Generation, Control, Switching and Protection

Protection Against "Iron Short" in Transformers. — F. AHRBERG. — The customary differential protective system of the Merz-Price type does not respond to an increase of internal iron losses in a transformer caused by a breakdown of insulation between iron laminations or core bolts. Yet this kind of failure is likely to occur on large power transformers and, if not detected in time, may cause serious damage. To react upon the increase in iron losses in case of such a failure, a relay of the wattmeter principle must be used. The article describes such an arrangement wherein two differentially connected potential transformers and two current transformers actuate a special wattmeter relay. This apparatus not only gives a signal when the iron losses mount above their normal value, but a scale on the main relay indicates at any time the amount of these losses on the protected transformer. The protection is not affected by overloads, short circuits or grounds.—*Siemens Zeitschrift*, June, 1926.

Control Equipment for Electrically Driven Central-Station Auxiliaries.—W. C. PLUMER and J. W. DODGE.—In the central station automatic control equipment is used to maintain nicety of adjustment, and hence quality and continuity of service, rather than for the starting and protection of apparatus. In this paper an analysis of control features in central-station practice is given in detail.—*General Electric Review*, September, 1926.

Transmission, Substations and Distribution

St. Légier Automatic Rectifier and Rotary Converter Substation of the Chemins de Fer Électriques Veveysans.—A. DANZ.—The St. Légier substation is a composite, automatically controlled station in which the mercury-vapor rectifier takes the basic load while a rotary converter serves as a standby and works in parallel with the rectifier during the periods of peak load. The article describes the various steps which take place in the normal functioning of the plant as well as the provisions against damage to the apparatus. Included in the illustrations is a wiring diagram showing the connections to the two dissimilar types of converting equipment. — *Brown Boveri Review*, August, 1926.

Electromechanical Rectifier. — A. LATOUR.—All of the existing rectifiers of the electromechanical type—that is, with a synchronously revolving commutator—are more or less unreliable owing to troubles on the brushes. The wear of the brushes is considerable, and electrical losses are not negligible, particularly if sparking, even in the least degree, occurs. These facts have limited apparatus of this type to very small capacities—a few hundred watts was the maximum which could be expected. The author has developed a rectifier of the commutator type, but he avoids the customary solid brushes. The commutator is made of steel segments, a small centrifugal pump directing jets of mercury against them. The general arrangement is similar to the formerly much-used mercury jet interrupters for X-ray induction coils. A mathematical commutation, borne out by actual performance, indicated that a jet of mercury can be subjected to an exceedingly high current density without undue heating. A jet, for example, of only 1 sq.mm. cross-section and 4 mm. in length carries readily 600 amp. at a temperature rise not exceeding 50 deg. C. To prevent oxidation of the mercury the vessel holding the commutator is filled with an inert gas. The apparatus is built with vertical shaft, the small motor on top. A 2½-kw. model weighs but 33 kg. and operates at 97 per cent efficiency at all loads. A 30-kw. size has a weight of only 3.3 kg. per kilowatt. Long life, quick start, silent operation, indifference to short circuits, small floor space and weight, very low cost and high efficiency are among the many features of this novel rectifier.—*Revue Générale de l'Electricité*, June 5, 1926.

Units, Measurements and Instruments

Generation of Very Intense Magnetic Fields. — T. F. WALL. — The paper describes a method for generating magnetic fields of the order of magnitude of 1,000,000 gausses and for impressing such fields on a specimen of magnetic material at regular intervals, with a view to ascertaining whether any disturbance of the electronic orbits could be obtained of sufficient magnitude to produce a marked effect on the magnetization curve of the specimen. A comparison is given of the calculated and measured values of the transient currents for three different solenoids. It is found that, while the calculated values agree well with the measured values for solenoids with a relatively small number of turns of thick wire, there is an appreciable discrepancy in the case of a solenoid with a large number of turns of thin wire. An attempt is made to explain this discrepancy as due to the condenser effect of the contact emf. between the copper wire and the oil-soaked cotton insulation which is in contact with the wire.—*Journal of Institution of Electrical Engineers (England)*, July, 1926.

Portable Receiving Sets for Measuring Feld Strengths.—AXEL G. JENSEN.—This paper presents a description of the latest type of measuring set, involving the use of a current-dividing potentiometer accurate for frequencies up to about 1,500 kilocycles and having a field-strength range of about 20 to 200,000 microvolts per meter.—*Bulletin Reprint B-199, Bell Telephone Laboratories*, July, 1926.

Criterion for the Sensitivity of Armature Windings to Variations in the Commutating Field.—L. DREYFUS.—This article is the continuation of one appearing in last year's October and December issues by the same author. The previous article dealt with machines having an even number of slots per pole and a chording of less than one slot pitch. The author showed how difficult commutating conditions could be improved by using the fractional step chording (step coils). This article extends the theory to machines with an uneven number of slots per pole. In general, the author comes to the same conclusions for this type of winding, making a mathematical study of the subject and also discussing the relation of thickness of brush to commutator pitch. — *Teknisk Tidskrift (Swedish)*, June 5, 1926.

Motors and Control

Group Drive and Individually Motorized Drive.—F. H. PENNEY.—The author points out numerous advantages and disadvantages in either of the two systems, weighing the former against the latter as to what will be the result in the way of final costs for different installations at the end of a year's trial. He mentions numerous industries in which it would seem that group drives are unusually successful. Generally, he thinks, at the present time individual drives seem to predominate as far as newly installed equipment is concerned, noting, however, that if first cost is of extreme importance, group drive offers a much cheaper solution than the individual drive.—*Mechanical Engineering*, September, 1926.

Choice of Control for Synchronous Motors in Industrial Plants. — R. M. MATSON and D. W. MCLENEGAN.—Fundamental considerations of control equipment, full-voltage and reduced-voltage starting, manual and automatic control, protection and necessary instruments and meters for proper operation are discussed in sequence by the authors. Briefly, there are five main factors to be taken into account in the question of full-voltage starting: (1) Starting current and torque characteristics of synchronous motors of normal design; (2) the effect on the motor of starting it on full voltage; (3) the amount of starting current drawn by the motor when started on full voltage and its effect on the line voltage; (4) the effect which the sudden appli-

cation of the starting torque will have on the driven machine; (5) the amount of torque required to start and accelerate the load and its relation to the torque which the motor will develop on full voltage.—*General Electric Review*, September, 1926.

Illumination

Remote-Control Equipment for Street-Lighting Circuits.—H. R. CRAGO. — In this article the author proceeds to describe the development of suitable control equipment to provide centralized control for street-lighting circuits. Some of the advantages of centralized control were given as follows: (1) It eliminates the need for an operator to turn on street lights in outlying districts, (2) permits decentralization of street-lighting circuits, (3) releases central-station space occupied by street-lighting apparatus for other equipment, (4) provides additional duct space for removing street-lighting circuits from distribution ducts. — *General Electric Review*, September, 1926.

Economics of Lamp Choice.—D. J. BOLTON. — Lamps are first compared with other electrical apparatus as regards the possibility and the method of economic choice. Choice of type (carbon, metallic vacuum and gas-filled) is first considered and then choice of rating for a given type, the latter being treated both graphically and algebraically. Simple formulas are developed for the most economical rating, first with a fixed lamp and then with a fixed candlepower.—*Journal of Institution of Electrical Engineers* (*England*), August, 1926.

Electrophysics, Electrochemistry and Batteries

Positive Rays in Thermionic Vacuum Tubes Containing Alkali-Metal Vapors. —HERBERT E. IVES.—A tungsten filament was mounted in the middle of an evacuated bulb the walls of which were covered with potassium. Voltage-current curves were then obtained with the bulb at room temperature and at the temperature of liquid air. It was found that the voltage-current curve was not merely shifted but was changed in shape as well. The change of shape with rise of cell temperature is apparently due to the presence of positive ions of alkali metal.—*Bell Telephone Laboratories Reprint B-182*, February, 1926.

Electrodeposition of Rubber.—S. E. SHEPPARD and L. W. EBERLIN.—Experiments showed that not only could rubber be deposited electrically from natural latex preserved in ammonia, but also that artificial dispersions of rubber in water solutions of alkaline reaction could be used in a similar manner. Current densities tried in the experiment ranged from 0.1 amp. to 1 amp. per square inch. Rather wide variation in voltage and current density may be made without producing a great difference in the character of the product. The material has practically the same properties as commercial rubber sheets. — *No.* 234, *Publications from Eastman Kodak Company Research Laboratories*, 1925.

Traction

New Railway Controllers for Direct Current.—In interurban railway operation it is usual to employ two motors connected in parallel or two groups connected in parallel, each group consisting of two motors connected in series. These connections have the advantage that it is possible to obtain economical speeds which are in the approximate ratio of one to two. Other economical speeds are obtained by field weakening. If a motor becomes defective, the journey can be continued with the active motor or motor groups. By suitable adjustment of the reversing gear of this control, all poles of the damaged motor are disconnected. The controllers are made in three sizes, for thirteen, fifteen and seventeen switch elements. — *Brown, Boveri Review*, July, 1926.

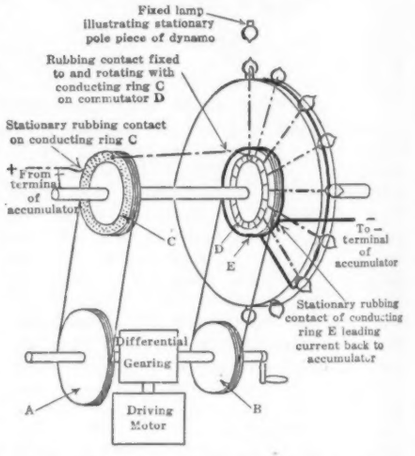
Moving Sidewalks. — T. PAUSERT.— The city of Paris is interested in finding an efficient method of moving pedestrians along certain much-traveled city arteries by means of electrically driven moving sidewalks. A prize contest was opened in 1922 for the best contrivances of this kind, and 45 schemes were submitted. Two of these have been chosen by the committee in charge as the most meritorious, and full-size models were recently finished and tested. Both systems provide a uniformly moving platform, with seats mounted upon it, running at a speed of about 10 miles per hour, the course being so arranged as to form a loop closed in itself. The first system consists of a large number of small cars, forming sections of the platform, with a motor-driven car every 150 ft., actuated by a 4-hp. motor. The direct-current supply comes through the rails, which are insulated from each other and the ground. Every 4,500 ft. a motor of 170 hp. helps to drive the platform. At definite points entrance and exit places are provided, where passengers enter upon moving gratings, operated in three sections at speeds of 2½, 5 and 7½ miles per hour. The second system is similar, but it is driven only by stationary motors of 100 hp. each, placed two each between every two entrance stations. It is estimated that these moving sidewalks can carry more than 72,000 persons per hour, while the Parisian subway carries only about 10,000 people per hour. Tests on two short experimental roads are not completed as yet. The cost of such an installation is estimated at about 29,000,000 francs per mile of double track. — *Revue Générale de l'Electricité*, June 5, 1926.

Telegraphy, Telephony, Radio and Signals

Cause and Elimination of Night Errors in Radio Direction Finding.— R. L. SMITH-ROSE and R. H. BARFIELD. —The paper describes experiments which have been carried out with a view to obtaining more conclusive evidence as to the causes of the apparent variations in bearings observed under certain conditions on wireless direction finders. In the course of the experiments the Adock "four-aerial" direction finder has been developed, and with its aid it has been shown that the actual deviation in azimuth of wireless waves is practically negligible.—*Journal of Institution of Electrical Engineers* (*England*), August, 1926.

Miscellaneous

Models and Analogies for Demonstrating Electrical Principles. — The teacher who is seeking animated models for use in a projection lantern to illustrate electrical action, or demonstration models based on mechanical analogies, will find in the illustrated article a considerable number of very serviceable suggestions. Some of these are quite elaborate, as, for instance, the rotating magnetic field model, of which the principle is shown in the accompanying diagram. The model comprises a number of electric lamps arranged around the periphery of a disk, to which a rotary motion is given by means of a handle through the wheel *B* and a belt drive. By commutator,


Fixed lamp illustrating stationary pole piece of dynamo
Rubbing contact fixed to and rotating with conducting ring C on commutator D
Stationary rubbing contact on conducting ring C
+ From terminal of accumulator
C
D
E
To − terminal of accumulator
Stationary rubbing contact of conducting ring E leading current back to accumulator
Differential Gearing
A
B
Driving Motor

ARRANGEMENT OF ROTATING FIELD MODEL

revolving brushes, an independent motor and a differential gear the lamps are lit successively, giving the effect of a traveling spot of light. Its movement depends on the "slip" between the speeds of the motor and of the handle; at synchronism, therefore, the spot is stationary.—*Engineer* (*England*) Aug. 13, 1926.

Experimental Study of the Relation Between Intermittent and Non-intermittent Sector-Wheel Photographic Exposures. — RAYMOND DAVIS. — This investigation on the effects of intermittent sector-wheel photographic exposures was prompted by data obtained years ago which were not in agreement with the results of other investigators. It is the accepted view that, compared with a continuous exposure, intermittence always causes a loss in photographic effect. The data shown here by the author prove that the effect may be either a gain, a loss or zero, dependent on the illumination. When the illumination is above a certain level a greater effect results from the intermittent exposure, and, conversely, for lower intensities a loss is obtained. The gain or loss, as the case may be, is accentuated by intermittence.—*Bulletin No.* 528, *Bureau of Standards.*

News of the Industry

More Record-Breaking Equipment

General Electric Company Building 208,000-Kw., 18,000-Volt Triple Turbo-Generator Set and Two 90,000-Kw. Machines—Westinghouse Making 104,000-Kw. Unit

A DESCRIPTION of the turbo-generator set to be built by the General Electric Company for the coming power station of the State Line Generating Company has just been issued by the manufacturers. This machine will have a total rating of 208,000 kw., dwarfing in that regard all competitors. It will be a triple unit, combining one 76,000-kw. generator on the high-pressure side with two 66,000-kw. elements on the low-pressure side. The manufacturers say that the turbo-generator will be unique in many respects. Not only will each of its three elements have a higher rating than any single unit now in operation, but it will incorporate the largest 1,800-r.p.m. generator ever constructed, it will be the first to use live steam for reheating, and it will be the first turbo-generator to deliver current at 18,000 volts. Delivery of the machine has been promised in eighteen months. Further details given out by the General Electric Company this week are as follows:

Steam is admitted to the high-pressure, 76,000-kw. element at 600 lb. pressure and 730 deg. F. From there, at reduced pressure and temperature, the steam passes to a reheater using live steam. After being raised to a temperature of 500 deg. F. by the live steam, it is divided and passed to the two 66,000-kw. turbines. A 4,000-kw. service generator is attached to each of the low-pressure units. Speed of rotation in the case of all elements is 1,800 r.p.m.

The complete weight of the machine will be approximately 2,000 tons. The heaviest individual part will weigh 275,000 lb. More than two tons of low-grade Illinois coal will be consumed each minute for steam generation. Cooling water, which will be pumped from and back into Lake Michigan, will amount to 400,000 gal. per minute, and the air used to cool the generators will total 350,000 cu.ft. per minute.

The State Line generating station will be erected on the Illinois-Indiana boundary and will be a very important factor in the Insull system in the Middle West. Its relation to the interconnected system around the southern end of Lake Michigan was described and illustrated in the issue of the ELECTRICAL WORLD for March 13 last (page 556). The companies which will receive energy from the new station include the Commonwealth Edison Company, the Public Service Company of Northern Illinois, the Northern Indiana Public Service Company and the Interstate Public Service Company. The State Line plant may reach an unprecedented size before it is declared complete—1,000,000 kw. having been named as its possible ultimate rating.

NEW UNIT FOR CRAWFORD AVENUE

An order for a steam turbo-generator unit rated at 104,000 kw. has been placed with the Westinghouse Electric & Manufacturing Company by the Commonwealth Edison Company of Chicago. The new unit is to be installed at the Crawford Avenue station, making a total of six turbo-generators there, aggregating about 450,000 kw. Three years ago the Crawford Avenue station, which enjoys the distinction of being the first high-pressure generating station in the United States, started with three units of 50,000 kw. to 60,000 kw. capacity each, two of American make and one of British make. Subsequently a 77,000-kw. unit was installed, and a 91,500-kw. General Electric unit is being built for it. The new Westinghouse turbo-generator, which, it is seen, has a much greater output of electrical energy than the preceding installations, will operate at 550 lb. gage pressure and 720 deg. F. temperature with a 29-in. vacuum.

The turbine's shipping weight will be approximately 1,250 tons. A long freight train will be required to carry the various parts from the works of the company to the power station in Chicago. The steam turbine will be built at the South Philadelphia works, while all the electrical equipment will be manufactured at the shops in East Pittsburgh.

EQUIPMENT FOR LOS ANGELES

Details of the new steam equipment ordered by the Southern California Edison Company for the station it is to build in Los Angeles have just been made public by the General Electric Company, the manufacturer. That the Southern California Edison is to build this station has been known for several months and allusions to it have been made in these columns, but reliable information on the design and exact rating of the units has hitherto been lacking.

This equipment embraces two electric generators, each nominally rated at 90,000 kw. at 90 per cent power factor or 100,000 kw. at unity power factor, though most efficient at 75 per cent. These generators, the General Electric Company says, are the "world's largest" in both capacity and physical dimensions and are to be driven by the two largest single turbines ever made. Two other unusual features have been incorporated. The armatures are being built with special heavy construction so as to be gas-tight, for the possible future adoption of the new system of hydrogen cooling. The machines are also the first to have a double-flow low-pressure end and four vertical condensers, with advantages of a simplified foundation and increased space for removal of condenser tubes.

The armatures of these generators, each weighing 330,000 lb., are of such size that they will be assembled at Los Angeles. Even if railroad cars with a capacity of 165 tons were available, it would be impossible to ship them by rail because of track, bridge and tunnel clearances.

The turbines are of the tandem-compound type, with a rating of 94,000 kw. at 90 per cent power factor or 105,000 kw. at unity power factor. The two generators are larger than the individual elements of any cross-compound turbine yet built. The New York Edison and Buffalo General Electric companies have 60,000-kw. single machines of General Electric manufacture. The main generators operate at 1,500 r.p.m.

They will be the first to produce current at 16,500 volts. In addition to the main generators, each unit is equipped with a house-service generator on the same shaft, rated at 4,000 kw. at 80 per cent power factor or 5,000 kw. at unity power factor.

The steam turbines driving the generators receive steam at a pressure of 400 lb. gage and a temperature of 725 deg. F. The exhaust steam is at a pressure of 1 in. absolute, so that practically all of the energy of the steam is extracted by the turbines. The boilers which will supply steam to the turbines will be so constructed that they can use either natural gas or oil as fuel.

Pennsylvania Electric Association in Convention

Getting down to business on Thursday, Sept. 9, the convention of the Pennsylvania Electric Association was in full swing at Bedford Springs, Pa., as the ELECTRICAL WORLD went to press. Addresses in the afternoon by H. V. Bozell of Bonbright & Company, New York, and William E. Mitchell, vice-president Alabama Power Company, followed a morning devoted to reports from officers and committees.

Mr. Bozell gave an engineer's interpretation of the financial side of the industry and the relation of the engineer's work to finance and Mr. Mitchell gave from his broad experience a discussion of numerous practical operating problems and how best to meet them.

For Thursday night a public policy meeting was scheduled, under the chairmanship of W. H. Johnson, president Philadelphia Electric Company, with addresses by President R. F. Pack of the National Electric Light Association, P. H. Gadsden, vice-president United Gas Improvement Company,

and John L. Stewart, member of the Pennsylvania Public Service Association. There was also a full program prepared for the Friday sessions.

Five hundred delegates were registered. A fuller report will be printed in a later issue.

I. E. S. in Convention

Spring Lake, N. J., Scene of Notable Gathering for the Twentieth Anniversary of Society

TWENTY years of progress in scientific lighting was celebrated in fitting style at Spring Lake, N. J., this week when the Illuminating Engineering Society met in annual convention with a historic record covering a score of twelvemonths behind it. More than three hundred delegates were present when the convention opened at the Essex and Sussex Hotel on Tuesday. Thomas N. McCarter, president Public Service Corporation of New Jersey, formally welcomed the visitors, complimenting the society on its effective work along lines which, he said, provided the electric light and power companies with their most remunerative load.

The presidential address of M. Luckiesh, director of the research laboratory at Nela Park, Cleveland, emphasized good lighting practice as the aim of the society. The program outlined on page 387 of the ELECTRICAL WORLD for Aug. 21 was carried out, eliciting an unusual degree of interest on the part of the members. The business sessions revealed excellent results from the extensive activities of the past year. The membership is increasing and new lines of endeavor are being pursued. A newly prepared lighting service manual for central stations was presented. This manual will be distributed by the National Electric Light Association.

Spectacular illumination of the hotel and beach and fine weather added to the enjoyment of the delegates and their friends. Entertainment, including "stunts" by members of the society, was provided in ample amount.

Institute Meets at Salt Lake City

Excellent Program at the Pacific Coast Convention—New Vacuum Switch Announced—President Chesney Emphasizes Research—H. J. Ryan Gets Edison Medal

IMPORTANT announcement of policy, the presentation of the Edison medal to Dr. Harris J. Ryan, an unusually good program and well-planned entertainments were outstanding features of the Pacific Coast convention of the American Institute of Electrical Engineers at Salt Lake City on Sept. 6 to 10. This convention followed the inauguration of President Cummings C. Chesney as president, and in an able address he stressed policies which he believed should be carried out this year under his administration.

At the opening meeting the delegates were welcomed by Governor George H. Dern of Utah, who compared the spirit of the electrical engineer with that of the Western pioneer and told how ably electrical engineers had played their part in the progress of civilization. In his response to the welcome President Chesney complimented the people of Utah on choosing an engineer for governor, saying that this fact denoted progress in American politics.

RESEARCH AND STANDARDIZATION

In his speech President Chesney outlined his conception of the Institute. He noted the great developments in the art and said that in his opinion several men stood out as leaders in that development. William Stanley and the transformer, Nicola Tesla and the induction motor, Benjamin Lamme and the converter railway motor and other machines, Shallenberger and the induction meter, and Steinmetz with his clear mathematical solution of the machine and circuit problems, were grouped as the men who had contributed most to recent progress. He urged that research be carried on and quoted at length from the last report of Dr. J. B. Whitehead of the research committee. The president cordially supported the ideas of Dr. Whitehead and urged Institute members to contribute both brains and money to the cause of research.

Allied with research, in the opinion of President Chesney, is standardization. He outlined the history of standardization and showed the enviable position that had been earned by the Institute. He then covered the recent developments in standardization in this country and placed himself on record as to what he believed should be the policy of the Institute. Vital quotations from his remarks on this topic are as follows:

"The American Institute of Electrical Engineers for the past twenty-five years, through its standards committee, has taken the initiative in the formulation of all the electrical standards of America, and its work is recognized as being authoritative throughout the entire world. Its procedure and its resulting standards during this period have been acceptable to the manufacturing and the consuming interests as well as to the general public. The industry has learned to value and depend upon the A.I.E.E. standards in commercial transactions covering matters of interest to all sections of the electrical industry. It has made no attempt to dictate to industry, but introduces standards on any particular line only when it is clear that all interested parties agree that the step is wise and desirable.

"In the Institute standards committee, or in its sub-committees, the manufacturer and purchaser and the general interests come together and develop the required standards in a way which has been generally satisfactory to all the interested sections of the industry. The electrical standards so issued have been identified with the name of the Institute, and its name should be continued in connection with them, and in the interest of simplicity and order it would appear that no other name was necessary. It should be remembered that the Institute as an organization has no interest other than one of public service, which duty the Institute has performed throughout the entire period of twenty-five years at its own expense. The Institute, therefore, in connection with the voluntary formulation of electrical standards, has assumed obligations during the past quarter of a century to the electrical industry and to the public which make it now impossible to discontinue the present practice or lessen its responsibilities until a more simple and direct method has been devised and demonstrated."

TRANSMISSION DEVELOPMENTS

The technical papers at the convention were of great value and on many topics. At the first session on Monday several papers on transmission topics were presented and discussed. Prof. H. J. Ryan and J. S. Carroll of Stanford University discussed the space charge that surrounds a conductor in corona and said that this work, which has so far been done in miniature, is to be continued on a larger scale. A paper describing in detail construction practice for 110-kv. lines was presented by L. R. Gamble, Washington Water Power Company, and a new 220-kv. line of the Southern California Edison Company was described by C. B. Carlson and H. Michener of that company. E. S. Healy and A. J. Wright of the Electric Bond & Share Company gave an excellent paper on the effect of unbalanced tension in a long-span transmission line, citing experimental data upon which the design of the Wallenpaupack line in Pennsylvania was based.

Tuesday morning's papers were "The Circle Diagram of a Transmission Network," by F. E. Terman, Stanford University; "Calibration of Lichtenberg Figures," by K. B. McEachron, General Electric Company; "Stability Characteristics of Alternators," by O. E. Shirley, General Electric Company, and "Synchronizing Power in Synchronous Machines," by H. V. Putnam, Westinghouse Electric & Manufacturing Company. All these proved excellent contributions to the proceedings.

A NEW TYPE OF SWITCH

At the afternoon session on Tuesday a notable paper on vacuum switches was presented by R. W. Sorensen and H. E. Mendenhall of the California Institute of Technology. They reported as the result of a series of experiments that there is great promise of the development of a vacuum switch which will interrupt large currents on high-voltage systems. The maximum rating used in the experimental development was 41,000 volts and 926 amp. Such a circuit was opened successfully many times without any pitting of the electrodes and without volatilization of the copper terminals.

A paper by Leonard Wilson on the electrification of lead-silver mines and one by Daniel Harrington on electricity in coal mining followed. These papers stressed the importance of proper installation and of reduction of hazards and gave rise to a good discussion. H. H. Henline of Stanford University

contributed a paper on "Engineering Education: Its History and Prospects," which also brought out animated debate.

On Wednesday four excellent papers were presented: "Protection of Oil Tanks Against Lightning," by F. W. Peek, Jr., General Electric Company; "Fire Protection of Alternating-Current Generators," by J. A. Johnson, Niagara Falls Power Company, and E. J. Burnham, General Electric Company; "Variable-Voltage Equipment for Electric Power Shovels," by R. W. McNeil, Westinghouse Electric & Manufacturing Company, and "Temperature of a Contact and Related Current-Interruption Problems," by Joseph Slepian, Westinghouse company. These were notable contributions, all well received.

At the annual dinner in the evening the Edison medal was presented to Dr. Harris J. Ryan of Stanford University "for his contributions to the science and art of high-tension transmission of power." In his response Dr. Ryan described some of the experimental work he is now conducting.

Thursday morning was devoted to papers dealing with electrical communication. At noon a well-attended excursion to Bingham Canyon started. Excursions and inspection trips also filled Friday, many delegates visiting the Utah Power & Light Company's Bear Lake-Bear River hydro-development and the generating station at Cutler, on the Lower Bear River. Many entertainment features during the convention were also participated in with zest by the visitors.

Abstracts of some important papers and discussions will be printed next week.

Tests of New Braunfels Plant Prove Satisfactory

Satisfactory preliminary tests have been made of the first unit of the power plant which the Comal Power Company, subsidiary of the San Antonio Public Service Company, is constructing at New Braunfels, Tex., according to E. H. Kifer, vice-president and general manager of the latter company. The first unit has a rating of 30,000 kw. and will be placed in operation about Oct. 1. When completed, the plant will have a capacity of 120,000 kw. Construction of the first 200 miles of transmission lines is about 75 per cent complete, and the remainder will be ready soon after the completion of the plant.

Work is under way on a high-tension line from New Braunfels to a point north of Boerne to connect with a distribution line of the West Texas Utilities Company, which will supply Comfort, Fredericksburg and intermediate points. Other lines which will be supplied by the New Braunfels plant, in addition to its service to the San Antonio Public Service Company, include a line to D'Hanis, which will supply Somerset, Lytle, LaCoste and Hondo; one north to Hunter for a connection with the Texas Power & Light Company, completed; one south to Pleasanton and Cotulla for connections with the Texas Central Power Company's system, and lines to Seguin and towns in that section.

Like the Trinidad plant of the Texas Power & Light Company on the Trinity River, of which the initial equipment is now in operation, the New Braunfels power station will burn pulverized lignite under its boilers.

Recent Extensions by Wisconsin Power & Light

Extensive construction projects carried on by the Wisconsin Power & Light Company during the current year will add a total of 172 miles to the company's transmission lines, says the Middle West Utilities *News Bulletin*. The 6,600-volt line from Portage to Endeavor and Packwaukee, in the central part of the state, was rebuilt early in the year, the crossing over the Fox River at Packwaukee being eliminated.

In that part of the company's territory lying a little further north, where the longest extensions were made, a loop has been completed from Heyman Falls to Marion, to Clintonville and back to Heyman Falls, the new section being that from Marion to Clintonville. Interconnection with the recently acquired Central Wisconsin Power Company's system has been effected by another new line from Clintonville through Big Falls and Iola which ties in with the Central Wisconsin Power lines at Wild Rose. An 11,400-volt line from Iola to Scandinavia will be carried on the same poles. The entire output from a new automatic 575-hp. hydro-electric plant on the Little Wolf River at Big Falls will be available for distribution over the Clintonville-Big Falls line, the voltage being stepped up to 33,000 for distribution.

HEAVY LINES SHOW NEW CONSTRUCTION IN NORTHERN TERRITORY

Philadelphia-Trenton Transmission Line Under Way

A 32-mile high-tension transmission line to carry electrical energy from Philadelphia to Trenton, N. J., is under way and progressing rapidly. The completion of this work, which is a major item in the thirteen-million-dollar extension and development program of the electrical department of the Public Service Electric & Gas Company for 1926, will result in the transmission of power from the Philadelphia Electric Company's plants across the Delaware River and into Trenton. The energy to be supplied by this new line is expected to meet the demand for service in and about that city for several years to come.

The line is being built partly by the Philadelphia Electric Company and partly by the subsidiaries of the Public Service Corporation of New Jersey. The Philadelphia Electric Company is constructing steel towers from its plant to Biles Island in the Delaware River. From Biles Island to a modern switching station being built in Trenton by the Public Service Production Company the transmission line is being constructed by the distribution department of the Public Service Electric & Gas Company. The new switching station, which is about 50 per cent completed, will transform the power received over the line and distribute it to substations, which will redistribute the electricity for industrial and domestic use.

Holston River Permits

Tennessee Eastern Asks for Five More —Appalachian Company Buys New River Company Rights

THE Tennessee Eastern Electric Company applied on Aug. 25 for another preliminary permit for five dams on the Holston River, its South Fork and the Watauga River, involving the generation, respectively, of approximately 100,000 hp., 60,000 hp., 25,000 hp., 25,000 hp. and 30,000 hp., or a total of 240,000 hp. Four of these projects were to be considered at the hearing at Johnson City, Tenn., to be held by Major Fiske, as already announced, on Friday, Sept. 10. The largest project—that to develop 100,000 hp. on the Holston River between Marble Hall and Galbraith Springs, Tenn.—will not be considered at that time.

The rights of the New River Development Company have been purchased by the Appalachian Electric Power Company of Richmond, Va. The latter company has applied to the Federal Power Commission for a license covering a development on New River near Radford, Va. It is proposed to construct a dam 110 ft. high and provide a reservoir 19 miles long covering 4,000 acres. The primary power which thus will be made available amounts to 10,176 hp. It is planned, however, to install four or five 20,000-hp. units.

This development has been the subject of controversy for many months. The New River Development Company contended that the project does not come within the purview of the federal water-power act. The engineers of the Federal Power Commission took an opposite view. The first examination made by the Chief of Engineers of the army sustained the power company. After vigorous protest had been made by the Governor of West Virginia, a more detailed study was made by the army engineers, with the result that the Chief of Engineers held that navigation in the Kanawha River would be affected by the development. The Appalachian company submitted its application for federal rights subject to withdrawal if the Federal Power Commission should find that the interests of interstate commerce were not involved.

The Stockport Milling Company of Stockport, Ohio, has applied for a

license covering a constructed plant at Dam No. 6 in the Muskingum River in Morgan County, Ohio. The War Department lease under which the plant was being operated recently expired.

The Wisconsin Power & Light Company of Madison has applied for a license covering a part of its project on the Wolf River.

The Great Western Power Company of San Francisco has applied to the commission for a license covering 38 mlies of 220,000-volt transmission line between Caribou Point and its Big Bend plant.

Amalgamation of Power Club and A. M. E. S. in Force

The amalgamation of the Electric Power Club and the Associated Manufacturers of Electrical Supplies voted by both societies at their last national conventions took effect on the first of this month under a new name—the National Electrical Manufacturers' Association. This body supersedes also the Electrical Manufacturers' Council, which, formed some years ago, had brought about fellowship between the two organizations now united. The Electrical Manufacturers' Council also served as an experimental laboratory from which data invaluable in the setting up of the National Electrical Manufacturers' Association were gained.

For the time being the old organizations will continue to function as in the past, and the Electric Power Club's scheduled meeting at Briarcliff Manor, N. Y., on Oct. 25-28, will be carried through as usual.

Lighting the National Exhibition at Toronto

The electric lighting for the Canadian National Exhibition at Toronto this year was more brilliant than ever before. Many important changes were made in the electrical equipment. Chief among these was the floodlighting of the scenery and colored stage lighting for the pageant. The illumination of the stage, which has been steadily improved during the past few years, was almost doubled this year. The result was obtained by the installation of the latest high-intensity projectors obtainable on the continent. There were almost 100 giant floodlamps and searchlamps on the grand-stand roof.

The chief operator had three alternative sources of power at his disposal —Hydro-Electric system lighting, direct current from a motor-generator in the grand stand and an auxiliary gasoline-driven motor-generator housed in the ring. The Toronto Hydro system completed a loop system of primary cables throughout the exhibition park, which meant that the accidental breakdown of one cable would not cause an interruption in the service of any building. The exhibition is self-contained so far as lighting goes. It has its own street lighting, its own underground and overhead systems, house lighting, commercial and power feeders, theater and stage effects and exhibit lighting. The decorative towers on the Midway alone carry more than ten thousand lamps.

Purchases and Mergers

Georgia, Missouri and Other States Report Transfers—Municipal Plants Still Give Up Ghost

ACQUISITION of the Rome (Ga.) Railway & Light Company by the Southeastern Power & Light Company was announced a few days ago. The former company, which furnishes electric light, power and transit in Rome and vicinity, was valued at about $2,000,000. Since 1912 the Georgia Railway & Power Company has been selling power at wholesale rates to the Rome company, which has in turn been retailing it to its customers. The merger is expected to provide more power for industry in the Rome section. Its effect is to extend still further the merger of public utility companies in Georgia which has been in progress during the past year and which has already brought into one system, controlled by the Southeastern Power & Light Company, approximately 140 cities and towns in the state, including Atlanta, Macon, Athens, Brunswick, Milledgeville and Dublin.

The Central States Light & Power Corporation, Davenport, Iowa, has filed a petition with the Missouri Public Service Commission for authority to purchase a controlling interest in the Missouri Electric Power Company, operating utilities in Perry, Stoddard, Wright, Douglas and Pulaski Counties in southern Missouri. The Iowa concern purposes to pay $212,400 for 177 shares of preferred stock outstanding and buy all of 1,000 outstanding common stock shares of the company. The Central States is holding company for the Northeastern Iowa Power Company, operating utilities in 75 towns and cities of Iowa; the Central Light & Power Company of North Dakota, operating in 11 cities and towns; the Nebraska Electric Power Company, operating in 21 towns and cities, and the Arkansas Public Service Company, with utilities in 12 towns and cities.

Announcement of the purchase of the East Missouri Power Company (Nickell & Bartow), with offices and central station at Troy, Lincoln County, by the Arkansas-Missouri Power Company (General Management & Engineering Corporation) has been made. The price paid is stated to have been $275,000 cash, $25,000 notes. The East Missouri Power Company serves Troy, Warrenton, Truesdale, Wright City, Jonesburg, St. Peters, Bellflower, Trenton, Hawk Point, Moscow Mills, Old Monroe, Winfield and Foley, all north of the Missouri River near its confluence with the Mississippi.

The Eastern Utilities Corporation of Chicago has purchased the municipal plant at Urbanna, Va., and the People's Light, Heat & Power Corporation at Westpoint, Va.

The Wisconsin Railroad Commission has approved the merger of the Wells Power Company, which supplied electricity in downtown Milwaukee, with the Milwaukee Electric Railway & Light Company. The purchase price was $700,000. The Milwaukee Electric company took over the operation of the Wells company under lease several years ago.

The municipal electric light system at Greenwood, Wis., has passed into private ownership, the people voting 111 to 29 in favor of selling out to the Northern States Power Company.

Arthur W. Johnson has acquired controlling stock in the Custer (S. D.) Electric Light & Power Company and assumed charge of the plant Sept. 1.

The Benton County (Ark.) Utilities Corporation has been formed and absorbed the municipal plants at Gravette and Sulphur Springs and the plant at Gentry formerly owned by F. E. Willmer & Company. It will also serve Decatur, all these places being in Arkansas.

G. M. Einhart of Roswell, N. M., is purchasing the municipal lighting plant at Alamogordo, N. M.

The Central Power & Light Company's offer of $200,000 for the municipal plant at Wellington, Tex., has been accepted.

The town of Lidderdale, Iowa, at a special election held Aug. 12, voted almost unanimously to sell its electric lighting distribution system to the Iowa Light, Heat & Power Company.

Regulating Quebec Streams

Some details of hydro-electric development work on twelve of the principal rivers in the Province of Quebec during 1925 are contained in the fourteenth annual report of the Quebec Streams Commission. In some cases the work carried out was in the nature of maintenance, while in other instances it was new construction or completion of work started in the preceding year.

On the St. Maurice River the flow of the river has been maintained at 16,500 cu.ft. per second at Shawinigan. Owing to the work which has been executed at La Gabelle, the provincial revenue from the St. Maurice Power Company will exceed $32,000 this year. From the St. Francis River frontier the commisson collected $20,000 in the fiscal year ended June, 1925, and since the first of June, 1925, the Southern Canada Power has been and will be assessed an annual contribution of $14,716 for its Hemmings Falls development. The cost of constructing the reservoir at Lake Metis has been $113,000, but good profits are expected from that source also. In June, 1925, the Lake Kenogami reservoir reached point 114.90. Its flow is well maintained.

The report states that most likely the commission will ask authority to start the regulation of the Gatineau River at Lake Daskatong so as to help the power development now in progress by the International Paper Company. In view of the lack of power on the south shore of the St. Lawrence, as compared with the large quantity available on the north shore, the commisson is studying the opportunity of regulating the waters of the Rivière du Loup. The same will be done for the Megiscane River and the Bastican River. The commission has also instructed its engineers to make a survey of the hydro-electric possibilities in the mining district of Rouyn and the upper Ottawa River. The establishment of a reservoir at Makanac, 25 miles north of Grand, Mère, is virtually decided upon.

League Council Market Development Plan

Details of the Program for Co-ordinating Product and Community Market Promotion Launched at the League Conference Last Week

By Earl E. Whitehorne
Vice-Chairman League Council

THE long-awaited program for local league co-ordination has been announced. Three years ago, at the second annual conference of the representatives of local electrical leagues, held at Association Island, Henderson Harbor, N. Y., it was urged that a national association of electrical leagues be organized so that an effective co-ordination might be developed between the leagues of the country in the development of the electrical market. A committee was appointed to study the situation and recommend a plan. As a result the League Council was formed, and after two years of deliberation it has come forward with a program that embraces in its intent the complete co-ordination of the co-operative market development work of the electrical industry both as regards promotion of products and in communities. In the development of this plan the League Council enlisted the assistance of the Society for Electrical Development, which at the request of the leagues has been acting as headquarters for league development and service pending the working out of a permanent program for league co-ordination. This plan was finally submitted last week to the annual league conference at Camp Co-operation VI, as already reported.

Financing of Leagues

As explained in the presentation of the plan before the conference, there have been three compelling motives calling insistently for a definite answer to the league problem. In the first place, the leagues themselves demanded some sort of an organization that would enable them to establish a co-operative relationship under their own control and direction, and various suggestions have been made to this end. The need for a practical field service to leagues, for interchange of experience, for co-ordination in market-building campaigns, and for mutual support in promoting the cause of the league as a new and growing factor in the mechanism of the electrical industry, all called for an active headquarters organization with a national scope, taking its authority and guidance from the leagues themselves. That was the league point of view, but there was another situation involving the manufacturer which was no less pressing.

In the early days of league organization these local groups naturally turned for funds to their own local power companies and to the larger national manufacturers, and the manufacturers through their local offices chipped in. When the growth in league development set in a few years ago the demands for contributions grew apace. Every new league that was started called immediately upon the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Western Electric Supply Department—now the Graybar Electric Company—and upon all other large national suppliers actively selling in the community. There are today 140 leagues operating in the country, of which only about 25 are so-called "Class A" leagues that have a paid secretary and a headquarters. At the present time national manufacturers are contributing in cash about $50,000 to local leagues, but the rapid acceleration of the league movement holds out the sure prospect of there being eventually some 400 leagues in the United States and Canada, all of which will be calling upon the manufacturers for money and quite naturally applying the "buyer's blackjack" to make the money come. The manufacturers feel that some orderly method of allocating and distributing funds to leagues must be set up. They are entirely favorable to league development and league support and expect to contribute increasingly as the effectiveness of the league as an instrument for local market development increases, but they rightly believe that these funds should be cleared from some central point in accordance with the support to which the individual leagues are entitled by their records of accomplishment. And thus there is a third consideration vital to the manufacturers and the leagues alike.

Financing of S. E. D.

The electrical industry has established and is maintaining the Society for Electrical Development as an industry institution for the service of all branches of the industry in the fields of publicity and sales promotion. When the league movement was crystallized in 1922 in the first league conference initiated by the society, it was perfectly obvious that the trained staff of the society provided the most available agency to render service to the leagues, and after full discussion the society was requested by the leagues to provide headquarters and field service to leagues wherever formed until the League Council could work out a plan for national co-ordination. Meanwhile, this interesting fact has developed. The society is supported by annual subscriptions from companies and individuals of all branches of the industry throughout the country. The leagues are likewise supported by local and some national subscriptions. As a result it has been the experience of the society that whenever it aided in the organization of a new league and helped to get it financed locally the society itself lost the support of some of its own members in that community because they transferred their subscriptions from the society to the league. The net result was that the more leagues the society helped develop the more local members it lost, with resultant cost to its own revenues. Yet it had taken on responsibility for league development. To the directors of the society, representative men of the four branches of the industry, this presented a pressing problem, for the society could not continue to render more and broader service to leagues if every league it bred absorbed some of the society's own membership and revenue needed directly in the work.

New Organization Plan

To meet this situation and give permanent direction to the entire league movement, the League Council, with J. E. North, president of the Electrical League of Cleveland and chairman of the League Council, presiding, presented the following plan, which was outlined in detail by W. L. Goodwin, vice-president of the Society for Electrical Development, who had actively collaborated in its evolution:

It is proposed that a practical merger be effected between the Society for Electrical Development and the leagues, whereby the leagues take charters from the society and assume a chapter relationship and the society, in turn, by accepting into national membership all members of the leagues, will become in effect the national chapter of the leagues, governed directly by elected representatives of this membership with complete geographic representation. To make this reorganization effective the following machinery will be set up in place of the present structure of the society, which now consists of a board of directors, elected by the members of the society; a League Council, acting as adviser to the society and the leagues; the publicity council, advisory to the society alone, and a headquarters staff:

1. A board of governors (national), to replace the present board of directors of the S.E.D., to control national organization policies, activities, programs and national operating funds, elected by the membership and holding quarterly meetings, with an executive committee functioning between meetings.

2. Section directors (national), heading commodity or product boards which will direct the market development programs of the various groups of manufacturers who join together to develop the national market co-operatively, such as the committees at present conducting the electric refrigerator, the electric commercial truck, the industrial truck and similar commodity campaigns now being operated through the society. For each product promotion actively set up a board of product section directors will be established.

3. A market development council (national), a co-ordinating body comprising the chairmen of the directors of each product section with members at large nominated by the chairman of the council and appointed by the president of the society. This council will outline potential market possibilities, advise in the formation of programs and co-ordinate the activities of all product sections.

4. A chapter council (national) takes the place of the present League Council and coordinates activities between the national and chapter organizations, determines policies and aids in forming and applying programs and activities developed either nationally or locally, assists in formation of new leagues and acts as the league directorate between the annual league conferences. Members of the chapter council will be elected from fifteen geographic districts in the United States, identical with the districts of the National Electric Light Association, and three districts in Canada. Members of the council are nominated by the presidents of all chapters in each district and elected by the representatives of all the chapters at the annual conference of leagues. Twelve members at large will be nominated by the chairman and appointeed by the president (national).

5. Annual league conference of representatives of all chapters will be held as at present for the discussion of the problems of the leagues.

6. An advertising and publicity council replaces the present advisory publicity council and aids in formulating all general publicity programs national in character and in co-ordinating the advertising done by chapters; studies advertising methods and media, etc.

7. An individual members' council replaces the present council and gives leadership and direction in extending the scope and influence of individual membership in leagues, which in turn give membership in the national society.

8. A sustaining membership council passes on enrollment of company members and amount of subscriptions to operating funds.

9. A president's council, ultimately to comprise a group of prominent men of other industries—bankers, government, universities, etc.—to act as an advisory council to the electrical industry in times of emergency.

LOCAL LEAGUE SET-UP

It is provided that the organization of the local chapter leagues shall be patterned exactly after the national organization in so far as is needed in each community. There is an ultimate possibility that 34 product sections may be set up in the national body, but the local chapter will organize local sections for only such of these commodity campaigns as they desire, or may group the whole market development activity in four functional divisions of wiring, lighting, appliances and industrial, as is now done in Cleveland. The national body will retain the name of the Society for Electrical Development, and the leagues will continue under their present names, or new leagues may take such names as they desire or adopt the name of the society as a local chapter. Each league will retain complete autonomy and freedom to engage upon such activities as it desires within such ethical and practical limitations as the leagues themselves may establish as national policy.

It is interesting to note that this plan sets up only two functioning bodies not already in operation—these being the market development council and the president's council. The intent of this organization is to provide an orderly basis by which successive groups of manufacturers of kindred products may undertake co-operative market development campaigns and so relate these product programs that they will be in proper balance and that the whole national program may be properly related to the local leagues. It will provide practical machinery for carrying forward market programs that may be initiated by the national associations of all branches of the industry with equal facility.

As to personnel, it was announced that John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, has consented to accept appointment as chairman of the market development council; J. E. North, of the Cleveland Electric Illuminating Company and president of the Cleveland Electrical League, will continue as chairman of the national chapter council, with L. D. Gibbs, Edison Electric Illuminating Company of Boston, as chairman of the advertising and publicity council and M. A. Curran, assistant to the vice-president of the Graybar Electric Company, as chairman of the individual members' council.

FINANCIAL PROGRAM

The financing of this whole project will require three funds under the plan. At the present time the budget of the principal leagues is upward of half a million dollars, of which, as stated, about $50,000 is contributed in subscriptions by national manufacturers. The balance comes from power companies, local manufacturers, jobbers, contractors and dealers. It is proposed to establish:

1. A national product development fund, which will be subscribed by manufacturers through the several product sections and by the participants in the activities of each particular section. This fund shall be used only for national programs, activities and services of the sections and will be controlled entirely by the directors of these sections.

2. A chapter product development fund, which will be subscribed by central stations, jobbers, contractors, dealers and others directly interested in chapter activities. This fund will be used entirely for local programs and activities of the leagues. It shall be controlled entirely by the product section chairman of the chapter. This fund will be raised for two purposes—to participate locally in national programs designed for local expression and to operate programs that may be designed and operated locally.

3. The organization operating fund—both national and chapter—consisting of membership subscriptions both from companies and individuals paid by national manufacturers direct to the national body and by the power companies, local manufacturers, jobbers, contractors and dealers direct to the leagues. The total of all membership funds will be prorated 50 per cent to the chapters and 50 per cent to the national body. The fund will be used to provide service facilities in the national and chapter operating organizations and to carry on market development programs and render service.

This means that half the membership dues that are collected by the chapter leagues will be remitted to the national headquarters and half the dues that are collected by the national headquarters will be distributed one-twelfth each month among the chapter leagues in proportion to the extent of the local membership. These membership subscriptions will be calculated on the following basis:

1. Central Stations—One-twentieth of 1 per cent on gross energy sales to consumers and one-fortieth of 1 per cent on gross merchandise sales; minimum $50.

2. Manufacturers—One-twentieth of 1 per cent on gross direct sales to consumers and one-fortieth of 1 per cent on gross sales clearing through jobbers or dealers; minimum $50.

3. Jobbers—One-fortieth of 1 per cent on gross sales; minimum $50.

4. Contractor-dealers—One-fortieth of 1 per cent on gross sales; minimum $25.

5. At-large members (national or chapter)—One-fortieth of 1 per cent of gross sales to electrical industry; minimum $25.

6. Individuals—Annual dues of $10.

Sales by power companies to other public utilities will not be included. Membership subscriptions for all companies doing a business of more than $25,000,000 will be arrived at by mutual consent.

It would appear from statistics quoted that by a curious coincidence the total qualifying gross sales of the national manufacturers that will be paid to the national body and the total qualifying gross sales of the central stations and other local companies that will be paid to the chapters will produce membership funds approximately the same in size, with the result that chapters will receive back from the national headquarters practically the same sum they remit. At first thought it would seem that this transfer of membership funds is foolish, but it is represented that to consider all subscriptions of national manufacturers as applicable for national purposes only and to restrict the use of all local funds to local purposes would tend to break down the very co-operation that it is sought to set up. Also, it would be impossible to prevent local interests from demanding special contributions from large national manufacturers for important local activities in which they are interested, whereas if their subscriptions are being distributed one-half to the chapters, the manufacturers are protected.

INDORSEMENTS

This market development program was submitted at preliminary meetings held at Association Island last week to the full League Council, to the advisory publicity council, to the board of directors of the Society for Electrical Development, and finally to the conference of leagues and received a unanimous vote of approval in every case. The conference, of course, was voting to express approval upon the principles involved in the plan only, for the league representatives present were not empowered to commit their leagues in any way. The program will be printed and submitted to all the leagues for study, interpretation and the adjustment of such details as may require recasting. It is proposed to carry the plan immediately to the more important leagues and to put the reorganization plan into effect, if this prove possible, on Jan. 1, 1927.

The presentation of the market development program on the floor of the league conference received a splendid indorsement. J. G. Barry, vice-president of the General Electric Company, speaking as a director of the S.E.D. and for the General Electric Company, indorsed the plan and said that he had studied it carefully and was confident that when it was understood it would receive the general support of the manufacturing industry. S. L. Nicholson, assistant vice-president of the Westinghouse Electric & Manufacturing Company, speaking also as a director of the S.E.D. and for the Westinghouse company, indorsed the plan and said that it will simplify the present complex organization for getting market development work done. M. A. Curran, speaking for the Graybar Electric Company, indorsed the plan. O. H. Caldwell, editor of *Electrical Merchandising*, indorsed the plan and pledged the support of the McGraw-Hill publications. G. Fred Laube, speaking as president of the Fixture Dealers' Association, gave hearty indorsement. L. W. Davis, executive manager of the Association of Electragists International, pledged the support of his organization. O. Fred Rost, president of the Newark Electrical Supply Company, spoke unofficially for the Electric Supply Jobbers' Association and indorsed it also. L. D. Gibbs of Boston, H. T. Brooks of Washington, Roger Gordon of Providence and A. L. Bush of New York spoke for the program. Stanley Dennis, editor of the *Electrical Record*, and F. E. Watts, manager of *Electrical Goods*, both pledged their publications to its support. The indorsements of many other prominent men of the industry were read into the record.

The conference voted to continue the present League Council in office pending action by the leagues and the establishment of the new program.

Wisconsin Electrical Men at Eau Claire

Delegates Discuss How Policy of Rate Reduction Can Be Kept Going —Successful Inauguration of Farm Service in State— Many Problems Are Canvassed

WAYS to reduce the cost of producing, transmitting and distributing electrical energy formed the principal subject of reports, addresses and discussions at the annual convention of the Electric Section of the Wisconsin Utilities Association, meeting in Eau Claire, Sept. 3 and 4. The convention was attended by approximately 150 delegates. Speakers advanced the idea that the industry is reaching the theoretical limit in decreasing costs of present-day operation and that only by adopting new methods can the record of rate reduction be kept up. Chairman G. G. Post sounded this keynote in opening the meeting, and his remarks were emphasized and re-emphasized in the succeeding papers and discussions.

Stating that the economies effected during the last decade had resulted in a decrease in electric service rates of about 8 per cent, while the cost of living has increased 70 per cent, Mr. Post told utility engineers, construction men and operators that in order to reduce the ratio of costs—fixed and operating—to revenue to a minimum it would be necessary either to minimize investment and operating costs or to increase revenue through increased use of service, or both. "In this connection," said Mr. Post, "we must not overlook the fact that the higher capacity of generating stations, which is accompanied by lower generating costs, is introducing complications into the transmission and distribution system which tend to increase costs. For example, switching equipment in substations costs more than previously because of the higher rupturing capacity required, and relay systems are becoming more intricate and costly owing to interconnections."

M. K. Drewry of the Milwaukee Electric Railway & Light Company said that only by the adoption of new methods could the electrical industry make the cost curve continue downward. "Use of 1,200-lb. steam pressure to save 15 per cent coal costs," Mr. Drewry said, "and adoption of low-temperature distillation to reduce coal costs about $1 per ton promise to help the cost and sale price curves move downward for several years to come." He detailed the history of low-temperature coal distillation and the expectations based on it, giving data collected by his company.

Rural Electrification

R. G. Walter, general superintendent of the Wisconsin Power & Light Company, said that there is an awakening on the part of the electric companies to the fact that farm electrification is here to stay. Special efforts have added 996 new customers to central-station lines during the first six months of this year, and 9,946 farms in Wisconsin are now being supplied from distribution systems, the average consumption per customer per month having increased to 42 kw.-hr.

Rural electrification, however, is, he said, only well begun. To specially trained men and men with a sympathetic attitude toward rural problems must be assigned the task of acquainting prospective customers with what can be done to serve them. Many farm customers are unacquainted with electrical aparatus and what electricity can do for them. There must be attention by the companies to see that the apparatus is kept in good working order, for if not kept in usable condition it will benefit neither the owner nor the utility company.

P. H. Walsh, a farmer, who was chairman of a farmers' committee which successfully developed a new rural rate plan affecting one thousand farm customers of the Wisconsin Power & Light Company, said that electric service is not a rich man's luxury but is a bread-and-butter necessity for any farmer who wants to make his work show a profit. He said many farmers still believe that the electric companies are "picking them for suckers." Utilities must do a great deal of educational work among the farmers, and when farmers take on electric service the companies must follow them up with advice on purchase of the proper appliances.

C. B. Hayden, service engineer of the Wisconsin Railroad Commission, said that he believed the average monthly kilowatt consumption of electricity on farms in Wisconsin in the next five years would increase to 80 kw.-hr. It is now 42 kw.-hr.

R. L. Dodd, chairman of the underground systems committee, declared that every utility company operating in an urban community is sooner or later confronted with the necessity of placing certain of its electric service lines underground. It may safely be stated that no electric utility should embark upon its first underground construction without a thoroughgoing study of the economic and construction factors involved, and it should then start only when necessity requires and the training of personnel permits. Likewise, any radical expansion of underground facilities, extension to higher voltage classifications or other decided departures from previously established practice may be beset with a train of mishaps, criticism and expense unless the entire staff is prepared to solve new problems correctly.

L. J. Beckwith, chairman of the radio co-ordination committee, urged the establishment of special departments to handle radio problems and interference complaints. "It is important," he said, "that the utility should consider three conditions—first, how electrical equipment may be a source of radio interference; second, how such sources of interference may be located; third, how a recurrence of such trouble can be prevented. There are three ways in which the electric utilities may benefit by the elimination of radio interference. They are: (1) Location of defective equipment before it becomes a hazard or causes service interruptions; (2) promotion of good will; (3) increased power consumption."

Other Papers

Others on the program and their subjects were: William C. Lounsbury, Superior Water, Light & Power Company, "How the Operating and Construction Man May Make Friends for His Company"; Prof. C. M. Jansky, University of Wisconsin, "The Education of Metermen," and E. S. Schrank, Wisconsin Public Service Corporation, Oshkosh, "Serious Effects of Fractional-Horsepower Motors on System Power Factor." A report on electrical fellowship work was made by R. E. Purucker, University of Wisconsin.

On the second day of the convention the delegates inspected the water-power plants of the Northern States Power Company at Wissota, Jim Falls and Cedar Falls. A novel entertainment feature was a program of vaudeville in which all the performers were men and women from the ranks of the light and power companies.

R. G. Walter of the Wisconsin Power & Light Company, Madison, and chairman of the rural lines committee of the association, was elected chairman of the section. Grant Ford, chief engineer of the Wisconsin Valley Electric Company, Wausau, was elected vice-chairman.

A.E.S.C. Year Book Shows Gains in Standardization

The movement toward standardization of industrial products has been considerably extended during the past year and savings from standardization work are constantly growing in magnitude, according to the year book of the American Engineering Standards Committee, recently issued. More than 200 definite standardization projects are in process or completed under the auspices of the A.E.S.C., and 365 national trade associations, technical societies and government bureaus are co-operating in the work through 1,600 representatives.

The general adoption of a comprehensive system of limit gaging developed by a representative committee of experts, the standardization of drafting-room practice and the standardization of the methods of graphically presenting facts are among the immediate objects which the committee has set for itself. Progress has been made on about 50 safety codes applicable to factories, and codes for paper and pulp mills, elevators and escalators, and for manufactured gas, were completed and approved during the year. Nineteen standardization projects dealing with the mining industry are under way.

For the convenience of American industry, the A.E.S.C. is maintaining a file of specifications to be sold at cost. These include standards issued by all of the foreign standardizing bodies with which it regularly exchanges information and standards, and also those of all the national trade associations and technical societies in the United States which have issued standards and specifications. This is done as a means of co-operation in the important

work represented in the National Directory of Commodity Specifications, recently published by the Department of Commerce.

The A.E.S.C. maintains an extensive file of specifications that are constantly referred to by engineers and experts in every field. About seven thousand standards are available for examination and reference in this way. A series of bulletins is being issued giving a fairly comprehensive picture of the work of standardization within individual companies.

The membership of the A.E.S.C. now consists of nineteen national trade associations, nine national technical societies and seven government departments. Charles E. Skinner, assistant director of engineering of the Westinghouse Electric & Manufacturing Company, is chairman of the committee. Copies of the year book may be had upon application to the office of the committee, 29 West Thirty-ninth Street, New York.

For Free Power Export

Colonel Kelly Puts Before Basle Conference Reasons Why Canada Should Favor It

ONE of the general topics brought before the sectional meeting of the World Power Conference at Basle, Switzerland, which came to a close this week, was "Exchange of Energy Between Countries." The American paper on this subject was contributed by Colonel William Kelly, retiring director of engineering at N.E.L.A. headquarters in New York. Colonel Kelly directed his remarks largely to the situation presented by the policy of Quebec in prohibiting the exportation of power from that province to the United States and the general inclination in the Dominion of Canada to restrict such exports to the minimum permitted under existing treaties. He had found in Canada some sentiment for the unrestricted export of power, and he analyzed the arguments of its advocates as follows:

1. Water power is valueless until developed. Unlike timber and mineral resources, it is not depleted by use. The earlier it is developed, therefore, the greater the benefit to be derived from it.

2. The feasibility of developing water power is largely dependent upon availability of market. By export a market may be obtained many years before it can be developed at home.

3. Until power is developed and available it is difficult to attract industries to its vicinity. After it is developed, if there are any industries that can profitably operate in its vicinity, they will have no difficulty in obtaining a preference over the foreign customers because of the heavy cost of long-distance transmission incident to export.

4. There is no difficulty in curtailing or stopping export provided the power exported is sold to public utilities on relatively short-term contracts and provided long-term contracts to individual industries are avoided. The recent development of large interconnected power utility companies offers a practicable and flexible market that makes feasible the immediate development of many large water powers that otherwise may wait years for an adequate local market.

5. Canadian laws restricting export of surplus electric power may bring into being laws taxing or restricting export of coal from the United States to Canada.

6. Operations in Ontario indicate that there are mutual benefits possible from an interchange of power which will be lost if the export of power is prohibited or greatly restricted.

At another point in his paper Colonel Kelly said:

"The principal problem for the earlier power development in Canada, as in the United States, was to find a market. This led in both countries to long-term contracts at very low rates. In several cases, based upon such contracts, large investments were made in industries which required large quantities of cheap power, and naturally these industrial investments make it very difficult to modify or terminate the power contracts on which they are dependent. With the growth of higher uses of power in both countries, many of the early long-term contracts have come to be looked upon as undesirable, and some of the sentiment in Canada against export of power doubtless can be attributed to these old contracts, regardless of the fact that the very growth of higher uses of power which makes the old contracts seem undesirable makes the use of such contracts unnecesary and improbable in connection with future developments.

COL. WILLIAM KELLY

"In New York and New England less than one-third of the electric power used is supplied by hydro-electric plants, the rest being supplied by steam plants. It is possible that this ratio can be maintained for a few years longer by developing the remaining water powers in the United States, but even if there were no restriction on export of water power from Canada, within twenty or twenty-five years, with the present growth of demand, the entire increase of load must be supplied by steam power. The cost of steam power in the principal centers, such as New York City and Boston, is not much greater than the cost of hydro power transmitted from Canada, so the effect of restriction on export of power from Canada, with possible local exceptions, is not likely to be important to the United States."

Briefer News

Sidney, Neb., Holds on to Its Plant.—The offer of the Western Public Service Company to purchase the Sidney (Neb.) municipal electric and water plant for $300,500, on a pledge to spend an additional $500,000 in extending power lines through the Lodge Pole valley for supplying irrigation projects and other towns, was rejected by the voters at a special election on Aug. 31 by 462 to 279.

Hydro Project for Merced River in California.—Application has been made to the California Division of Water Rights for permission to appropriate 2,000 sec.-ft. of water from the Merced River in Mariposa County, where it is proposed to develop 13,750 hp. by the construction of a dam 80 ft. high, 1,000 ft. long at the crest and 200 ft. at the base. Daniel McFarland of Storrie is the applicant, and the cost is estimated at $400,000.

Hearing at Milwaukee on the Wolf River Application.—A public hearing will be held by the United States district engineer in Milwaukee, Sept. 16, in connection with the project of the Wisconsin Power & Light Company on the Wolf River. The company proposes to install 9,600 hp. on the lands of the Menominee Indian reservation. The hearing has been requested by the Indian Defense Association, which is asking why the development cannot be undertaken with Indian funds instead of by a private company.

Electric Refrigeration Council Meets at Waldenwoods.—The program adopted for a meeting of the Electric Refrigeration Council at "Waldenwoods," Michigan, on Friday and Saturday of this week, and extending into Sunday, included talks by J. R. Crouse, A. H. Goss, F. M. Feiker, S. L. Nicholson, Francis E. Neagle, W. L. Goodwin, Alex Dow, Earl E. Whitehorne and others prominently concerned in promoting electric refrigeration. There was an executive hour, when representatives of manufacturers spoke, and committee meetings, as well as a dinner, sports and entertainment.

California Sells Land for a Project in Sacramento District.—The sale of 560 acres of California state land to the American River Hydro-Electric Company as a dam site for a proposed seven-million-dollar water and power project is announced by the state board of control. The land lies just east of Folsom prison, and the proposed reservoir would be the heart of an irrigation and water supply system for 150,000 acres lying around Sacramento. The state received $150,000 for the property, the company agreeing further to supply in perpetuity all the water and electricity needed by the prison.

Kansas City Power & Light Enters West Texas Field. — The Panhandle Power & Light Company, a subsidiary of the Kansas City Power & Light Company, will construct a twelve-hundred-

thousand-dollar plant to serve the oil fields recently developed in west Texas, according to an announcement made by Chester C. Smith, vice-president of the Kansas City Power & Light Company. The plant will be on the Canadian River, about 60 miles northeast of Amarillo. The first unit will be of 5,000 kw. Additions will be made as requirements indicate. The plant will be operating not later than Nov. 1.

Indiana Conservationists May Oppose Dam on the Wabash River.—Officials of the Indiana Conservation Commission are making a study of the possibilities which may attend the recent action of the Federal Power Commission in granting to the Wabash Hydro-Electric Company a preliminary permit to construct an 18-ft. dam and generating station across the Wabash River at Cedar Rapids, 6 miles west of Logansport. State officials are expected to register a formal protest. They will insist that the state receive a royalty, that fish ladders be provided and that the proper water stage be preserved.

"World's Biggest" Radio Transmitter.—A vacuum-tube transmitter 80 times as powerful as the ordinary transmitter in a broadcasting station has just been installed in the naval radio station at San Diego, Cal., according to the Radio Division, Bureau of Engineering, Department of the Navy. This sending vacuum tube, built by the General Electric Company, radiates 80,000 watts of electrical energy and is said by officials of that concern to be the most powerful tube transmitter in the world. This broadcasting device was not designed for telephone use, it was explained, but will be employed for radio-telegraph communication.

Electric Club of Seattle Elects Well-Known Men as Officers.—Newly elected officers of the Electric Club of Seattle, installed in office on Aug. 23, include: J. D. Ross, superintendent of Seattle's municipal lighting department, president; R. M. Boykin, general manager Seattle district, Puget Sound Power & Light Company, vice-president; A. J. Lutz, manager Pacific States Electric Company, Seattle, second vice-president; D. U. Chamberlin, president of the Globe Electric Company, treasurer, and P. L. Hoadley, representing Stanley & Patterson, Seattle district, executive secretary. The club is considering the organizing of an electrical exposition.

Rural Service in Idaho.—A well-attended and widely representative convention to promote the use of electricity on farms was held at Caldwell, Idaho, recently. R. E. Shepherd of Jerome, Idaho, president of the State Chamber of Commerce, was chairman. Dean E. J. Iddings of the department of agriculture of the Idaho State University told of the electrical development on the farms in eastern Idaho, and particularly in the vicinity of Idaho Falls, making the statement that there is greater use of electricity in farm homes in Bonneville and neighboring counties than in any other section of the state and that the use is more varied. He recommended a study of conditions in that part of the state. He also said that the state experimental farm near Caldwell is to be completely electrified.

Empire State Association Arranges Program.—For its twenty-second annual convention at Lake Placid, N. Y., on Oct. 4 and 5, the Empire State Gas and Electric Association has arranged a program including, in addition to committee reports on highway lighting and farm service by F. D. Corey and C. S. Ruffner respectively, an address on "Selection and Training of Utility Company Employees" by S. S. Board, director of the Yale Graduate Placement Bureau, and one on "Management Problems of the Holding Company" by Dr. Theodore J. Grayson, director evening schools, University of Pennsylvania. George R. Van Namee, member New York Public Service Commission, and Bishop D. L. Ferris are also down for addresses, and M. S. Sloan will report for the New York State Committee on Public Utility Information.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 13-16. O. A. Weller, Public Service Co., Denver.

New England Division, N. E. L. A.—Poland Spring House, Poland, Me., Sept. 20-23. Miss O. A. Bursiel, 149 Tremont St., Boston.

International Association of Municipal Electricians — Battery Park Hotel, Asheville, N. C., Sept. 21-24. E. H. Benz, West New York, N. J.

Great Lakes Division, N. E. L. A.—French Lick, Ind., Sept. 23-25. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Wisconsin Chapter, Western Section International Association of Electrical Inspectors—Milwaukee, Sept. 27 and 28. Harvey Griem, City Hall, West Allis, Wis.

Association of Edison Illuminating Companies — Chateau Frontenac, Quebec, Sept. 27-Oct. 1. P. S. Millar, 80th St. and East End Ave., New York.

Public Utilities Association of West Virginia—Charleston, W. Va., Oct. 1 and 2, A. Bliss McCrum, secretary.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 4 and 5. C. H. B. Chapin, Grand Central Terminal, New York.

Pennsylvania State Association of Electrical Contractors and Dealers—Elks' Club, Philadelphia, Oct. 4-6. M. G. Sellers, 1202 Locust St., Philadelphia.

American Electric Railway Association—Cleveland, Oct. 4-8. J. W. Welsh, 292 Madison Ave., New York.

American Electrochemical Society — Hotel Washington, Washington, Oct. 7-9. C. G. Fink, Columbia University, New York.

North Atlantic Section, American Society of Agricultural Engineers—State College, Pa., Oct. 11-13. R. T. Wagner, 1 River Road, Schenectady, N. Y.

Kansas Section, N. E. L. A.—Manhattan, Kan., Oct. 14-16. H. Lee Jones, 401 National Reserve Bldg., Topeka, Kan.

Electrical Supply Jobbers' Association — Atlantic City, Oct. 18-22. F. Overbagh, 411 South Clinton St., Chicago.

Electric Power Club—Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

National Safety Council — Detroit, Mich., Oct. 25-29. W. H. Cameron, 168 N. Michigan Ave., Chicago.

Power from the Yosemite.—An adjustment of the boundaries of the Yosemite National Park so as to eliminate twelve acres from the southwest corner of the reservation has been recommended by F. E. Bonner, district engineer at San Francisco for the Forest Service. This change is regarded as desirable so as to permit the development of the power resources of the South Fork of the Merced River. An application covering the project has been filed by the San Joaquin Light & Power Corporation. A reservoir essential to the development inundates an obscure corner of the park without any claim to scenic beauty. A dam 330 ft. high will make possible the development of 33,800 hp. of primary power.

Another Hydro Plant for the Yadkin River.—Contract has been let by the Tallassee Power Company of Badin, N. C., for the construction of a large power house and storage dam at High Rock on the Yadkin River, according to announcement by S. A. Copp, general superintendent of the company. The construction work will be done by the Southern Power Company of Charlotte, and when in operation the power developed will all be taken by that company. It is planned to develop 40,000 hp. The water conserved will be used by the aluminum plant at Badin. It has sometimes been necessary in the past to shut down this plant on account of drought, and is declared that water stored by the projected dam will make future shutdowns on this account altogether improbable. The new dam will be 59 ft. high and about 1,200 ft. long. The lake will cover 19,000 acres. The project may cost $12,000,000.

Maryland Commission Gets Briefs in Hagerstown Dispute.—Briefs for the applicants and protestants were filed last week with the Public Service Commission of Maryland in the application of the Mayor and City Council of Hagerstown for authority to erect a new municipal electric plant and to issue bonds to the amount of $300,000 to finance the enterprise. Filing of the briefs follows numerous hearings, held after special legislation passed to enable the plant to escape the commission's jurisdiction had been declared unconstitutional by the courts. The Potomac Edison Company, a competitor of the municipal plant, has opposed the application on the ground that the project involves a duplication of investment. This company contends that it is equipped to meet any demand for energy in its territory. The municipality stresses the point that it is not proposing to enter upon a new enterprise and that it has supplied service for twenty years.

Further Plans for Hydro Plant on Cowlitz River.—Preliminary steps for the development of the proposed twenty-million-dollar hydro-electric project of the Grays Harbor Railway & Light Company of Aberdeen, Wash., on the Cowlitz River, near Mayfield, are progressing rapidly, W. W. Briggs, manager of the company, reports. Mr. Briggs states that it is probable that two dams will be constructed in the

development—the main one in the vicinity of Mayfield and a second dam at Mossy Rock, a canyon about 9 miles above Mayfield. This will create an impounding basin to insure an adequate supply at all times. Mr. Briggs states that the height of the two dams will be determined largely upon the power contracts that the company obtains previous to the actual construction. Negotiations are now under way with several large corporations contemplating plants in the Grays Harbor district, and the amount of power they will require will materially influence the company's plans. The first development program calls for expenditure of $8,000,000.

Nebraska Section, N.E.L.A., Has Another Commercial Camp. — Under the charge of the commercial committee of the Nebraska Section of the National Electric Light Association the second annual camp for managers and salesmen of service and merchandise was held at Crete, Neb., on Aug. 26 to 29 inclusive. Sales and service talks were interspersed with athletic exercises under professional guidance. J. E. Davidson, chairman Commercial National Section, was unable to be present but wired greetings and encouragement. The first day's program was devoted to electric cooking and the sale of electric ranges; the next day was given over to home and commercial lighting, while electric refrigeration was the subject for the third day. P. L. Mills, J. W. Busch, R. B. Kellogg, J. M. Hickerson, C. A. Nash, P. O. Wilson, J. A. Corcoran and E. H. Aberdeen were the men from outside the state who addressed the gathering. W. J. Krug is chairman of the commercial committee. The general chairman of the camp committee was H. F. Boehner of the Nebraska Gas & Electric Company, Lincoln.

North American's Wisconsin Companies Get New Sources of Supply.— The Milwaukee Electric Railway & Light Company has contracted to buy the entire output of the hydro-electric plant which the Northern Paper Mills Company of Green Bay is building at Chalk Hill Rapids, near Amberg, Wis. This addition to the Milwaukee Electric company's power supply in Wisconsin and upper Michigan will be about 40,000,000 kw.-hr. a year, which will be used to supply the Milwaukee and Fox River valley industrial areas during high-water levels. The White Rapids and Chalk Rapids plants of the Northern Paper Mills, which will be the largest in operation on the Menominee River, will have a combined annual output of 66,000,00 kw.-hr. They are expected to be in operation by next spring. Power developed at the White Rapids plant will be sent to the Northern Paper Mills plant at Green Bay over 70 miles of recently completed 132,000-volt steel transmission line on towers to be used jointly with the Milwaukee Electric company's subsidiary, the Wisconsin Gas & Electric Company. The organization by the Northern Paper Mills Company of the Northern Electric Company to handle this development was noted recently. The latter company will not, however, rank as a public utility company, as was asserted.

Men of the Industry

F. R. Phillips Made General Manager of Duquesne Company

Frank R. Phillips, general manager of the Pittsburgh Railways Company for the past few years, has been appointed vice-president and general manager of the Duquesne Light Company, according to an announcement made by A. W. Robertson, president of the Duquesne company. Mr. Phillips is an outstanding figure in public utility affairs and has been connected with the utilities in Pittsburgh for the past seventeen years. His electrical experience has been broad, including service in various capacities with electric utility companies and as designing engineer for many electrical devices.

After completing his education in Cleveland in 1894, Mr. Phillips became master mechanic of the Cleveland City

F. R. PHILLIPS

Railway Company. Following this he served as mechanical and electrical engineer for the Union Light, Heat & Power Company of Covington, Ky., the Bellevue Water Company of Covington and the South Covington & Cincinnati Street Railways Company. He removed to Pittsburgh in the fall of 1909 to assist in the development of the street-railway industry in that city. In 1910 Mr. Phillips was made superintendent of equipment, a position he filled until July, 1923, when he was made acting general manager for the receivers following the death of the late P. N. Jones. Upon the lifting of the receivership Feb. 1, 1924, Mr. Phillips was made mechanical and electrical engineer and was also appointed the representative of the company to the traction conference board.

Mr. Phillips is a member of the American Institute of Electrical Engineers and the Engineers' Society of Western Pennsylvania and is nationally known through his activities in the American Electric Railway Association.

Gilbert I. Vincent, manager of the Syracuse (N. Y.) Lighting Company for several years, has been elected vice-president. Mr. Vincent's promotion comes as a result of the control of the Syracuse company passing from the United Gas Improvement Company of Philadelphia to the Mohawk-Hudson Corporation of Schenectady, N. Y. **Ernest Johnston,** auditor, was elected secretary and assistant treasurer.

Magnus W. Alexander, president of the National Industrial Conference Board, returned from Europe Sept. 6 aboard the Hamburg-American liner *Albert Ballin.*

R. O. Quick has been appointed director of public relations of the Wisconsin Power & Light Company, succeeding A. P. Gale, who was made manager recently of the Beloit properties of the company.

C. E. Anderson of Worcester, Mass., has been appointed business manager for the Southside division of the Virginia Public Service Company, to succeed **Matthew Robb,** who has returned to his home at Frederick, Md. Mr. Anderson is a graduate of the Worcester Polytechnic Institute and was formerly connected with the General Electric Company for two years.

Thomas N. Wynne, second vice-president and chief mechanical engineer of the Indianapolis Light & Heat Company, has resigned his connection with the company and his duties have been assigned to **E. G. Ralston,** third vice-president, who has been chief electrical engineer. It has been rumored persistently that Mr. Wynne would resign since the Wynne estate disposed of its stock in the company to the Middle West Utilities Company, an Insull corporation, early this year. Mr. Ralston has been in the employ of the company since 1913 in various capacities and for several years has been chief electrical engineer.

Frederick E. Schornstein, district manager of the Indiana Power Company at Huntington, Ind., has tendered his resignation and will move to Grand Rapids, Mich., where he will become general manager and part owner of a creamery company. He went to Huntington in 1925, and before that he was connected with the interests of Joseph H. Brewer of Grand Rapids, who amalgamated many utilities in Indiana.

Frederick Krug, formerly superintendent of power production of the Porto Rico Railway, Light & Power Company, San Juan, Porto Rico, has recently been appointed assistant to C. C. Giles, who is now president of that company as well as of the Porto Rico Railways Company, Ltd., the holding company. **H. E. Riggs** was promoted to the position of superintendent of power production, and **H. M. Hazlett** was placed in charge of the Comerio hydro plants. Mr. Krug has been affiliated with the Porto Rico properties since 1922, when he became superintendent of the La Plaza hydro-electric plant of the Porto Rico Railway, Light & Power Company. He had formerly served as assistant superintendent of the electrical department of the New York-Honduras Rosario Mining Company.

J. W. McElroy, assistant superintendent of the Iowa Southern Utilities Company, Centerville, Iowa, has been advanced to be general superintendent of

the Burlington district of the company, succeeding the late John Chase. Mr. McElroy has been with the Iowa Southern Utilities four years and had an important part in the reorganization of the Burlington plant and the erection of the new power station when the plant was taken over. **D. D. Bentzinger**, who has been in charge, will return to Centerville to his regular post as assistant to the general manager.

W. L. Barbee has been appointed distribution engineer of the construction division of the Puget Sound Power & Light Company to fill the vacancy caused by the resignation of D. R. Nankervis.

D. C. Bertrand, formerly connected with the Great Western Power Company, San Francisco, has resigned to become affiliated with the Electric Equipment & Engineering Company, Aberdeen, Wash.

C. P. Kinkaid has been appointed superintendent of the Valley division of the Puget Sound Power & Light Company to succeed C. S. Noble, who resigned to join the Tampa Electric Company.

Rudolph Martens of Thoner & Martens, Boston, has returned to this country after a sojourn of three months abroad. Mr. Martens reports during his travels an interesting trip to Hell, a town near Trondjhem, the ancient capital of Norway.

J. E. Patterson has been made manager of the Abitibi Power & Paper Company at Iroquois Falls, Ontario, in succession to R. A. McInnes, resigned. Mr. Patterson has been with the company since 1913, rising from a clerical post to be general superintendent.

Herbert H. Rogge of the Westinghouse Electric International Company has been appointed representative of that company at Manila. The territory which Mr. Rogge will have under his jurisdiction will be the Philippine Islands, Dutch East Indies, Siam and the Federated Malay States.

John H. N. Adams, for three years director of publicity for the Chamber of Commerce, San Diego, Cal., has resigned to become advertising manager of the Mountain States Power Company, with headquarters at Tacoma, Wash. Mr. Adams is a native of New York and obtained his education in New Jersey schools.

Obituary

Walter L. J. Melvin, general manager of the Hygrade Lamp Company, Salem, Mass., died suddenly at Lynn, Mass., Sept. 5. Mr. Melvin was a native of Swampscott, Mass., and was 46 years of age. He had been in the field of incandescent lamp manufacture all his business life and had been manager of the Hygrade company since 1920. Previously he was employed by the General Electric Company, the Franklin Electric Manufacturing Company, Hartford, Conn., and the Westinghouse Lamp Company. In the field of employee relations he was exceptionally successful, and he was highly regarded in eastern New England electrical circles.

Commission Rulings

Nebraska Commission Postpones Its Depreciation Reserve Inquiry.—Deciding that it is advisable to wait until the joint investigation by the Interstate Commerce Commission and various state commissions of the rules that should cover credits and debits to depreciation reserve accounts of public utilities, the Nebraska State Railway Commission has dismissed the proceedings it began several years ago to bring about an agreement on how these accounts should be kept. Each class of utilities argued for the set of rules it deemed advantageous, and one divergence of opinion was over whether charges to this account should be on the basis of investment or replacement cost. The Nebraska commission, understanding that no conclusions have yet been reached in the nation-wide investigation because there the same diverse interests and conflicting situations are involved, has indefinitely deferred its own inquiry with the proviso that it may be renewed later in the light of wider experience.

Territory in Field of One Company Will Not Be Diverted to That of Another Merely on Promise of Lower Rates.—A complaint made by the city of Vineland, N. J., against the New Jersey Electric Company led the Board of Public Utility Commissioners of New Jersey to say that, under a statute authorizing the division of territory between electric companies as will best serve the public convenience and interest, an electric company will not be permitted to extend its line into territory that should properly be available to another company for the development of business which it is capable to serve. This principle will be sustained by the commission even where there is a substantial difference in rates between the companies and the one proposing the extension serves at the lower rate, if the extension will be a decided departure from the main business of the company and will pre-empt all the territory available for the development of the other company, one comparatively small in business and financial strength, and if the territory in dispute is of a lean character and should be developed only as the new business will reasonably pay.

Commission Without Jurisdiction Over Complaint of Franchise Owner Not Furnishing Service.—The Missouri Public Service Commission received a complaint from the owner of a municipal franchise granted by the city of Seneca to the effect that he would suffer loss by the confirmation of another franchise issued by the same city to the Empire District Electric Company, which purchased the municipal plant. The commission declared itself without any jurisdiction in the matter of the complaint, saying: "The petition of the intervener and the testimony show that the intervener is asking this commission to disapprove the sale of the franchise and electric light system by the city of Seneca to the company for the reason that it would result in financial loss to the intervener. The commission is interested in the citizens of Seneca being furnished adequate electric service, but we have no jurisdiction to settle any controversy that may exist between the intervener and the city of Seneca. The law does not contemplate that this commission should either grant or withhold a certificate of convenience and necessity on consideration of any individual's monetary or financial interests. Whether one should be granted or withheld must depend on the testimony as to the presence or absence of the necessity for the service and its convenience or otherwise to the people and community to be served."

Recent Court Decisions

What Is Necessary in Order to Claim Possession of Indeterminate Permit?—Where a city, acting as a public utility, maintained a power plant, a company which contracted to deliver electrical energy to this plant and constructed a transmission line in the city streets for that purpose did not thereby acquire an "indeterminate permit" as defined by the Wisconsin statutes. So holding in Central Wisconsin Power Company vs. Wisconsin Traction, Light, Heat & Power Company, the Supreme Court of Wisconsin said that such a permit could be acquired only as provided in the law, especially as the company was not dealing with the public directly or indirectly, had acquired no certificate of convenience and necessity and no effort had been made to divide the field. The court could not, it said, extend by construction beyond the boundaries marked by the Legislature a statute conferring monopolistic privilege upon utility companies. (209 N.W. 755.)*

Physicians' Opinion that Electric Shock Might Cause Subsequent Paralysis Warranted Sending Case to Jury.—In Altmire vs. Madison Coal Corporation damages were awarded to the plaintiff, who had suffered a paralytic stroke which he ascribed to an electric shock received two days previously from contact with a trolley wire in the mine where he worked, this wire having improperly been left charged at a time when it was customary to turn the current off and depend on mules for transportation. Doubt was thrown on the cause to which his stroke was ascribed, but inasmuch as two physicians had testified, though in opposition to four or five others, that an electric shock might so manifest itself, the Court of Appeals of Kentucky held that the necessary "scintilla of proof" to warrant sending the case to the jury had been adduced. On other points raised, however, the judgment was reversed and the case remanded. (284 S.W. 1068.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Market Moderate

Holiday Period Affects Trading in Electric Light and Power Stocks Materially

IN THE week prior to the Labor Day holiday period trading in power and light stocks was only moderately active since traders were for the most part absent on vacation. Important changes for the week nevertheless represented gains in more instances than losses. No pronounced change has occurred in the position of money and new financing naturally has been limited. While Central Maine Power preferred rose eight points during the week, that was an exception and, this stock being an inactive issue, is not representative. Advances in general did not exceed two or three points.

Among the issues that showed improvement were Columbus Electric & Power, which advanced no less than five points during the week. Others which gained in smaller degree were Galveston-Houston Electric and Northern States Power.

Losses were sustained by American Public Utilities prior preferred and Penn Ohio Securities preferred.

General Gas & Electric Corporation's Income Statement

The General Gas & Electric Corporation, the W. S. Barstow holding company, has issued the following consolidated income statement for the year ended July 31, 1926, as compared with 1925:

	1926	1925
Operating revenue	$22,659,237	$20,078,288
Operating expenses and taxes	$11,100,133	$9,756,946
Maintenance	2,342,709	2,445,575
Depreciation	1,107,564	1,076,260
Rentals	397,016	406,738
Total operating expenses, maintenance, depreciation, taxes and rentals	$14,947,423	$13,685,521
Operating income	$7,711,813	$6,392,766
Other income	595,170	482,261
Total income	$8,306,984	$6,875,027
Deductions:		
Interest on funded debt	$3,519,780	$3,502,889
Other deductions from income	462,067	447,687
Preferred stock dividends of subsidiaries	1,583,313	1,156,361
Minority interests	203,874	122,726
Total deductions	$5,769,036	$5,229,664
Balance	$2,537,947	$1,645,363

Barrows Reiterates Objections to Proposed Merger

Firmly declaring that the directors of the Narragansett Electric Lighting Company, Providence, R. I., are unanimously opposed to the merger with the United Electric Railways proposed by interests identified with the banking house of Bodell & Company of that city, President E. A. Barrows of the Narragansett company has issued another statement on behalf of the directors and addressed to stockholders. The offer of $86 per share for Narragansett stock by the proponents of the merger is emphatically condemned as being below the value of this security, and in reply to contentions that rates could be reduced under the merger plan the point is made that if it should go through, the annual earnings necessary to pay interest and dividends would exceed the present Narragansett dividends by about $1,500,000.

On Thursday the Narragansett company presented a proposal to the board of directors of the United Electric Railways for the co-ordination of power resources of the two companies. President Barrows stated to the ELECTRICAL WORLD that the proposal involves no merger of the two companies, but merely the joint use of such generating-plant transmission and distribution facilities as recent engineering investigation shows to be practicable. Further particulars of the proposal will be published next week.

Arkansas Utility Bonds Called.—All of the outstanding first lien and refunding mortgage gold bonds of the Arkansas Central Power Company, 6 per cent series, due 1948, have been called for payment Oct. 1.

American Water Works Earnings Expand

Company Shares Growth of Rapidly Expanding Industrial Area—Bond Interest Earned Three and Two-fifths Times

ORGANIZED as a holding company under the laws of Virginia in 1914, the American Water Works & Electric Company, Inc., owns and controls the operation of a powerful group of electric and waterworks public utilities throughout the United States. The company's electric properties are in one of the world's leading industrial areas —that section comprising western Pennsylvania, northern West Virginia, Maryland and northern Virginia.

As a consequence of the rapid growth of the company's business earnings have grown rapidly. For the year ended June 30 last gross earnings amounted to $43,333,284. Operating costs, taxes and maintenance took $22,789,138, and other deductions, such as interest and amortization charges and preferred dividends of subsidiaries, $13,680,895. This left a balance of $6,863,249, of which $3,112,335 was reserved for renewals and replacements, leaving $3,750,914 net income. Annual interest charges on the funded debt of the parent company were $1,114,545, so that available income is three and two-fifths times interest requirements on the total funded debt, including the recent debenture issue. This is regarded as a quite satisfactory ratio.

In comparison with the calendar year 1925, net profits for the year ended June 30 show a growth of $433,399, or 13 per cent. Earnings on each share of first preferred, participating preferred and common for the past five years, were:

	First Preferred	Participating Preferred	Common
1921	$24.23	$9.39	$3.68
1922	26.18	13.24	7.24
1923	36.73	27.38	21.38
1924	28.84	19.77	2.85
1925	23.61	....	3.56

The operating ratio of the company —i.e., the ratio between gross earnings and operating expenses—is 53 per cent, which is about average for a concern of this type.

The capital structure of the company is relatively simple. There is an issue of 6 per cent gold debentures, of which $8,000,000 is outstanding. This was sold last November at 94½ and interest to yield 6.35 per cent, for the purpose of acquiring new properties and of securing additional working capital. Then comes an issue of collateral trust 5 per cent bonds totaling $12,690,900, due 1934. Stock issues comprise $14,050,000 worth of 7 per cent cumulative first preferred of $100 par and 632,122 shares of common of $20 par.

A feature of the company's structure is the special surplus account of $1,250,000, created from the realized profits of the company and the undistributed profits of its subsidiaries, to finance the refunding and construction requirements of the subsidiary water companies.

Commonwealth Power Calls Bonds.—Certain 25-year 6 per cent secured sinking-fund gold bonds of the Commonwealth Power Corporation dated May 15, 1922, and aggregating $309,400, have been called for redemption Oct. 4 at 105 and interest.

Cincinnati Gas & Electric to Retire Securities.—Certain of the prior lien and refunding mortgage 40-year sinking-fund gold bonds, series A, of the Cincinnati Gas & Electric Company, aggregating $46,500, have been called for payment Oct. 1 at 110 and interest.

Electric Storage Battery Listing.—The Philadelphia Stock Exchange has authorized the listing of 3,782 addi-

tional shares of no-par-value common stock, being part of 25,000 shares applied for listing in the company's application dated March 17, 1926, to be listed on official notice of issuance full paid to employees under a plan instituted in 1923, making a total of 801,699 shares of common stock listed on Aug. 23.

Electrical Manufacturing Company Calls Stock.—Preferred stock of the Electric Controller & Manufacturing Company to the amount of $142,300 has been called for payment Oct. 1 at 110 per share. This reduces the amount of preferred stock outstanding to about $200,000.

New England Power Company to Issue Stock.—Authority to issue common stock to the amount of $5,100,000 has been sought by the New England Power Company from the Massachusetts Department of Public Utilities. Proceeds from the sale will be used to discharge obligations in connection with extensions, additions and improvements to the company's plant. The company also asked for permission to cancel 22,000 shares of unissued preferred stock and to issue a similar amount of common stock in their place.

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of July:

Name of Company	Gross Earnings for July 1926	1925
Augusta-Aiken Ry. & Elec....	$122,923	$93,570
Baton Rouge Electric.....	76,168	63,934
Blackstone Valley Gas & Elec.	395,939	369,737
Cape Breton Electric, Ltd....	46,679	36,872
Columbia Gas & Electric.....	2,481,282	2,406,316
Columbus Elec. & Power.....	310,691	201,607
Edison Elec. Illg. (Brockton).	122,003	110,344
Elec. Lt. & Pwr. Co. of Abington and Rockland.....	47,699	48,323
Galveston-Houston Elec.....	397,054	329,054
Idaho Power.....	257,615	257,760
Lowell Electric Light.....	124,095	109,534
North Texas Electric.....	204,816	186,401
Puget Sound Power & Light...	1,036,403	1,001,492
Savannah Elec. & Power.....	175,267	154,753
Sierra Pacific Electric.....	104,859	96,632
Tampa Electric.....	374,405	241,879
Washington Water Power....	510,130	483,242
York Utilities.....	14,239	14,012

Portland Electric Power Securities Listed.—The New York Stock Exchange has authorized the listing of additional first lien and refunding mortgage gold bonds, series B, of the Portland Electric Power Company to the amount of $500,000, making the total amount of series B bonds, the listing of which has been applied for (after deducting bonds retired and canceled), $12,629,600, of which total $4,908,400 is now outstanding in the name of the Portland Railway, Light & Power Company and $7,721,200 in the present name.

Stockholders' Rights.—Offering of 44,000 shares of additional common stock has been made to stockholders of the Tennessee Electric Power Company at $70 per share, in the ratio of one new share for each three and a half shares already held. Payments were accepted in cash, in second preferred stock at $85 a share flat or in second preferred and cash.

Milwaukee Company Calls Bonds.—Coincident with the distribution of the regular quarterly dividend of $1.75 per share to the 11,126 customer-owners of the Milwaukee Electric Railway & Light Company, President S. B. Way announced that $8,541,000 of 6 per cent refunding first mortgage bonds have been called for redemption as of Sept. 1 and that they will be refunded with 5 per cent bonds, which will result in a substantial saving in interest charges. The company's balance sheet shows gross assets of $102,271,901. During the forepart of the year its capital

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Sept. 7	Low 1926	High 1926
ABITIBI PWR. & PAPER, com. —no par	k 90	70¼	91¼
Adirondack Pwr. & Lt.—7% pf.	107½	....	....
Adirondack Pwr. & Lt.—8% pf.	113	....	....
Ala. Pwr., pf.	105½	....	....
Allis-Chalmers Mfg. pf.	k109½	105	110½
Allis-Chalmers Mfg., com.	90	78½	94½
Aluminum Co. of Amer., com.	69	....	....
Aluminum Co. of Amer. new, pf.	101	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	91	89	98
Amer. & Foreign Pwr., com.—no par	21	15½	42¾
Amer. Bosch Magneto, com—no par	21½	16	34¼
Amer. Brown, Boveri, Elec.	47	30½	50
Amer. Brown, Boveri, Elec., pf.	k 97	86½	97½
Amer. Elec. pwr., pf.	m111	102	111
Amer. Gas & Elec., 6% pf.—no par.	95½	90½	95½
Amer. Gas & Elec., com.—no par.	106½	64	106½
Amer. Lt. & Trac., 6% pf.	107	105	115½
Amer. Lt. & Trac., com.	221	195	263
Amer. Pwr. & Lt., 6% pf.	97½	92	99
Amer. Pwr. & Lt., com.—no par.	k 66½	50½	72
Amer. Pub. Serv., 7% pf.	a 97	92	99
Amer. Pub. Serv., com.	50	45	80
Amer. Pub. Utilities, 6% pf.	87	....	....
Amer. Pub. Utilities, 7% pf.	k 95	88	95
Amer. Pub. Utilities, com.	76	....	....
Amer. States Sec., A	3	....	....
Amer. States Sec. B	2½	....	....
Amer. Superpwr., pf.—25	23¼	....	....
Amer. Superpower, pf.	k 93	90	94
Amer. Superpwr., Class A—no par.	k 29½	19½	37½
Amer. Superpwr., Class B—no par.	30½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	k107	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	60	43½	74
Anaconda Copper	50½	41½	51½
Appalachian Pwr., 7% pf.	98	99	101
Appalachian Pwr., 1st pf., 7%	98	99	102
Appalachian Pwr., com.	78	78	83
Arizona Pwr., 7% pf.	62	99	107
Arkansas Cent. Pwr., pf., $7—no par	k104	....	....
Arkansas Lt. & Pwr., 7% pf.	102	....	....
Arkansas Lt. & Pwr., com.	100	110	115¾
Asheville Pwr. & Lt., 7% pf.	l107½	100½	107½
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	84	....	....
Assoc. Gas & Elec., Class A—no par	38	25½	38¼
BABCOCK & WILCOX, com.	119	117	151
Binghamton Lt., Ht. & Pwr., pf.	105	105	110
Birmingham Elec. pf.—$7—no par	104	....	....
Blackstone Valley Gas & Elec., pf.	k103	103	106
Blackstone Valley G.&E., com.—50.	103	103	106
Blaw-Knox, com.	f 67	45	67
Brazilian Trac., Lt. & Pwr., com.	f119	....	....
Broad River Pwr., pf.	94	....	....
Brooklyn Edison, com.	159½	138	159½
Buffalo, Niagara&East.Pwr.,pf.—25.	24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	31½	....	....
CALIFORNIA ELEC. GENERATING, pf.	92	89	95
California Ry. & Pwr., pf.	m 90	88	115
Carolina Pwr. & Lt., pf.—$7—no par	107	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 93	89½	96½
Cent. & S. W. Ut., pr. In. pf.—no par	a 98½	93	100
Central Ariz. Lt. & Pwr., pf.	104	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	99	99½
Central Ill. Pub. Serv., 6% pf.	a 88½	87	91
Central Ind. Pwr., 7% pf.	87½	84	87½
Central Pwr. & Lt., pf.	97½	....	....
Central States Elec., 7% pf.	89½	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m115	110	116
Chicago Fuse Mfg., com., no par.	a 31	30	35
Cincinnati Gas & Elec., com.	g 90½	88	95
Cities Service, 6% pf.	l 89½	86½	89½
Cities Service, pf.B—10.	l 7½	7½	7½
Cities Service, pf. BB—100.	l 77½	74	79
Cities Service, com.—20.	l 44½	37½	44½
Cities Service, Bks. Shrs.—10.	l 22½	19½	22½
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	106½	....	....
Cleveland Elec., Illg., com.	290	....	....
Colorado Pwr., 7% pf.	k 95	96	97
Columbia Gas & Elec., 7% pf.	112½	112	115½
Columbia Gas & E., com.—no par.	83½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	65	96
Columbus Elec. & Pwr., 2d pf.	104	....	....
Columbus Elec. & Pwr., com.	260	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	k 98½	98	99½
Columbus Ry., Pwr. & Lt., pf. B.	k 93	92	97½
Col. Ry., Pwr. & Lt., com.—no par.	60	....	....
Commonwealth Edison, com.	a137½	135½	145
Commonwealth Pwr., 6% pf.	88½	82	88½
Commonwealth Pwr., com—no par.	41½	28½	42½
Conn. Lt. & Pwr., 8% pf.	k116	117	121
Conn. Lt. & Pwr., 7% pf.	108	....	....
Cons. Gas of N. Y., pf.—50.	59	....	....
Cons. Gas of N.Y., com.—no par.	113	87	115½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	k104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½ % pf.	e111½	108½	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e113½	109	113½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e127½	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	e 53½	45	57½
Cons. Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	97½	....	....
Consumers Pwr., 6.6% pf.	103½	....	....
Continental Gas & Elec., 7% pfc. pf	101	....	....
Continental Gas & Elec., 7% pr. pf.	96½	....	....
Continental G.&E., com.—no par.	k130	85	150
Crocker Wheeler, com.	19	....	....
Crocker Wheeler, pf.	54	....	....
DALLAS PWR. & LT., 7% pf.	k106	102	107½
Dayton Pwr. & Lt., 6% pf.	105	....	....
Detroit Edison, com.	139	123½	141½
Dubilier Condenser & Rado, com.—no par	k 6½	4½	11
Dubuque Elec., 6% pf.	94	94	98½
Duquesne Lt., 7% pf.	d115	112	115½
EAST. N. Y. UTIL. pf.	103	80	104
Eastern New York Util., com.	65	70	75
Eastern States Power.	15	....	....
Eastern States Power, pf.	88	....	....
Eastern Tex. Elec., 7% pf.	104	....	....
East. Tex. Elec., com.—no par.	75	70	80
Edison Elec. Illum. of Boston, com.	d229	....	....
E. Paso Elec., com.—no par	70	70	94
E. Paso Elec. pf.	100	....	....
Elec. Bond & Share, 6% pf.	l107½	103½	109½
E. Bd. & Share Sec., com.—no par.	l 75	56½	86
El. Household Util.	a 12½	13	25
Elec. Investors, 6% pf.—no par.	93	....	....
Elec. Investors, com.—no par.	45½	30½	74½
Elec. Investors, 10% pd. receipts.	20	12	56
Elec. Pwr. & Lt., ctfs. pf.	98	89½	98
Elec. Pwr. & Lt., ctfs., 40% pd.	105½	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	m104½	103	110½
Elec. Pwr. & Lt., ctfs., com—no par.	19½	15½	34½
Elec. Refrig.	67½	61½	78½
Elec. Ry. Securities, com.—no par.	m 6	4½	10
Elec. Storage Battery, com.—no par.	90½	71½	94½
Elmira Wtr., Lt. & R. R., 7% pf.	99	97½	99½
Emerson Elec., pf.	m101	100	104½
Empire Dist. Elec., 6% pf.	l 88	82	88
Empire Power, A	25½	....	....
Engr. Pub. Serv., pf.—no par.	m 96	87	96
Engr. Pub. Serv., com.—no par.	m 24	24	29½
Eureka Vac. Cleaner, com.—no par.	52½	43	56
FAIRBANKS MORSE, pf.	k111	108½	115
Fairbanks Morse, com.—no par.	k 52	46	59½
Federal Lt. & Trac., com.	34½	28	49½
Federal Light & Traction, pf.	k 86½	86	89
Federal Utilities, pf.	70	....	....
Federal Utilities, com.	17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l107½	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	53	....	....
Galveston-Hstn. El., com.	21	....	....
Gen. Elec., com.	92	79	95½
Gen. Elec., special—10.	11½	11	11½
Gen. G.&E., (Del.) com. A no par.	51½	34	59
Gen. G.&E., (Del.) com. B no par.	m 45½	45	48¾
Gen. G.&E., (Del.) A pf. $8 no par.	k110	105½	110½
Gen. G.&E., (Del.) A pf. $7 no par.	k 99	95	99½
Gen. G.&E. (Del.) pf. B.	k 94	92½	96
General Public Service, pf.	m104	90	106½
General Public Service, com.	k 12	12	16½
Ga. Lt., Pwr., & Rys., 6% pf.	93	82	96
Ga. Lt., Pwr. & Rys., com.	70	65	80
Ga. Ry. & Power, 8% pf.	k114	112	114
Ga. Ry. & Power, 7% pf.	104	....	....
Ga. Ry. & Pwr., 4% pf.	k120	105	145
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	h101	....	....
IDAHO PWR., 7% pf.	103	103	106
Ill. No. Utilities, 6% pf.	a 91	90	92
Ill. Pwr. & Lt., 7% pf.	99½	....	....
Ingersoll Rand	100	80½	105
Int. Combus. Engr., com.—no par	56½	33½	64½
Int. Utilities, class A—no par.	k 30	30	39
Int. Utilities, class B—no par.	4½	4½	9½
Interstate Pwr., pf., no par.	90½	....	....
Interstate Pub. Serv., 7% pf.	97	96½	99
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	94	....	....
Jersey Central Pwr. & Lt., pfc., pf.	110	95½	112
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	150	120	165

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Saturday, Sept. 4. lBid, low, high, Wednesday, Sept. 8. mLatest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Sept. 7	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	k111	107½	112½
Kansas Gas & Elec., 7% pf.	l102½	99	103
Kentucky Hydro-Elec., pf.	a 95	91½	95½
Kentucky Sec., 6% pf.	80	..	....
Kentucky Sec., com.	100½	....	....
Kentucky Utilities, 6% pf.	a 51	49	52½
Keystone Pwr. & Lt. 7% pf.	96½	95	99
LACLEDE GAS LT., com.	k163	146	175½
Lehigh Pwr. Sec., com.—no par	17½	10	22
Long Island Ltg., 7% pf.	108½	....	....
Long Island Ltg., com.—no par	120	120	150
Los Angeles Gas & Elec., 6% pf.	98	....	....
Louisville Gas & Elec., Class. A	24½	22½	26½
MANHATTAN ELEC. SUPPLY.	83	56	87½
Manila Elec., com.—no par	k 35	27½	39
Maytag Mfg., com.	24½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	108½	105	109
Metro. Edison, pf.—$6—no par	92	....	....
Metropolitan Edison, pf., $7, no par.	103	....	....
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a106½	97½	111½
Middle West Utilities, 7% pr. lien pf.	a114½	106½	123½
Middle West Utilities, com.—no par.	a112½	108	134½
Midland Utilities, pr. ln. pf.	a102	98	104
Midland Utilities pf. A	a 99	96	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	98	100	102
Milwaukee Elec. Ry. & Lt., 6% pf.	91	87	88½
Minn. Pwr. & Lt., 7% pf.	l104½	100	104
Miss. Pwr. & Lt., pf.	105	....	....
Miss. River Pwr., 6% pf.	95	....	....
Miss. River Pwr., com.	60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	102½	102½	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par	99½	....	....
Mohawk Hudson Pwr., com.—no par	25½	20½	28½
Montana Pwr., pf.	m117½	112½	119½
Montana Pwr., com.	80½	69½	83½
Montreal Pwr., com.	f 71	....	....
Mountain States Pwr. pf.	97	....	....
Mountain States Pwr., com.	18	....	....
NASSAU & SUFFLOK, LTG., pf.	98	....	....
National Carbon, pf.	a126	125	128
National Electric Pwr. A	a 24	19½	26½
National Elec. Pwr., pf.	a 95	92	96½
Nat. Lt., Ht. & Pwr., com.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	101½	96	102½
National Pwr. & Lt., com.—no par.	22½	16½	38½
National Pub. Serv., 7% pf.	k 91	90	95½
National Pub. Serv., pte. pf.	111	....	....
National Pub. Serv., A com.—no par.	k 20½	15½	24
National Pub. Serv., B com.—no par.	15½	10	17½
Nebraska Pwr., 7% pf.	l106½	103	107½
Nevada-Calif., Elec., com.	k 25	18½	44½
New Brunswick Pwr., pf.	50	30	55
New England Pub. Serv., pr. ln. pf.	97	98	99½
New England Pub. Serv., pf.	89	95½	97
N. J. Pwr. & Lt., 7% pf.	105	104	110
New Orleans Pub. Serv., 7% pf.	102½	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	98	98	100
Newport News & Hampton Ry., Gas & Elec., com.	109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	109	98	114
Niagara Falls Pwr., 7% pf.—25.	k 28½	27½	28½
Niagara, Lock & Ont. Pwr., 7% pf.	109	110	111½
No. Amer., 6% pf.—50.	51½	49	52½
No. Amer., com.—10	[55½	42	67
No. Amer. Edison pf.—no par	96	91½	96½
No. Amer. Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par.	93	....	....
Northeastern Pwr., com.	19½	17½	36½
No. Indiana Gas & Elec., pf. A.	100	98	103
No. Indiana Public Service—pf.	100½	99	103
No. N. Y. Utilities, 7% pf.	104	....	....
No. Ohio Pwr., com.—no par	15½	11	26½
No. Ohio Trac. & Lt., 6% pf.	80	78	81
No. Ohio Trac. & Lt., 7% pf.	93	88	96
No. Ont. Lt. & Pwr., pf.	k 82	78	84
No. Ont. Lt. & Pwr., com.	73	45	75
No. States Pwr., 7% pf.	102	....	....
No. States Pwr. com.	107½	97	136½
No. Texas Elec., 6% pf.	54	....	....
No Texas Elec., com.	20	....	....
OHIO BRASS, com. B—no par	74	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	94	92	95
Ohio Pwr., 6% pf.	94½	93	96
Ohio Pub. Serv., 6% pf.	l 94	90	96
Ohio Pub. Serv., 7% pf.	l 99	96	100
Ohio River Edison, pf.	101½	...	...
Oklahoma Gas & Elec., pf.	96	...	...
PACIFIC GAS & ELEC., 6% pf.	100½	....	....
Pacific Gas & Elec. com.	131½	118	132½
Pacific Pwr. & Lt., 7% pf.	l102½	98	102½
Parr Shoals Pwr., 6% pf.	92	90	95
Penn Central Lt & Pwr., pf.—no par	c 72½	71	91
Penn-Ohio Edison, 7% pf.	96	....	....
Penn-Ohio Elec., 7% pf.	95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	96	94	97
Penn-Ohio Pwr., & Lt., 8% pf.	107½	105	108
Penn Pwr. & Lt.—$7—no par.	l107½	103	108½
Penn Pub. Serv., 7% pf.	101	96	103
Penn Pub. Serv., 6% pf.	85	85	90
Penn Wtr. & Pwr., com.	k143	140	165
Philla. Co., 6% pf.—50.	50	47½	51½
Philla. Co., com.—50.	k 73½	59½	76½
Philla. Elec. com.—25.	c 51	41½	67½
Pittsburgh Utilities, pf.—10.	m 17	14½	20½
Portland Elec. Pwr., 7% pf.	100½	....	....
Portland Elec. Pwr., 6% pf.	k 84	71	80
Portland Elec. Pwr., 6% 2nd pf.	k 72	71	75
Portland Elec. Pwr., com.	31	....	....
Potomac Elec. Pwr., pf.	l107½	....	....
Pwr. Corp. of N.Y., com—no par.	m 79	77½	90½
Pwr. Sec., pf.—no par.	k 10	10	29
Pwr. Sec., com.—no par.	k 4	4	13
Pub. Serv. of N. J., 7% pf.	k107	103½	109½
Pub. Serv. of N. J., 8% pf.	k123½	115	123½
Pub. Serv. of N. J., com.—no par.	91	72	93½
Pub. Serv. of No. Ill., 6% pf.	k101	101	103
Public Serv. of No. Ill., 7% pf.	a114	112	116½
Pub. Serv. of No. Ill., com.—no par	a132½	128½	140
Pub. Serv. of No. Ill., com.	a133	129½	143
Pub. Serv. of Okla., 7% pf.	95	92	97
Pub. Serv. Elec. & Gas, 6% pf.	k101½	97	104
Public Service Elec. Pwr., pf.	k113	106	114
Puget Sound Pwr. & Lt., 7% pf.	102	....	....
Puget Sound Pwr. & Lt., 6% pf.	m 84	....	....
Puget Sound Pwr., & Lt., com.	27½	26½	66½
RADIO CORP. OF AM., pf.—50.	48	44½	48½
Radio Corp. of Amer., com.—no par.	49½	32	49½
Republic Ry. & Lt., pf.	106	....	....
Republic Ry. & Lt., com.	78	....	....
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	k101	100	103
Rochester Gas & Elec., 7% pf.	104	105	107
SAN JOAQUIN LT. & PWR., 7% pf.	97	97½	98½
Safety Cable, com.	53½	42½	54½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	67	60	70
Servel Corp.	19½	17½	22½
Sierra Pacific Elec., com.	27	....	....
Sioux City Gas & Elec., 7% pf.	k 98½	96	101
S. E. Pwr. & Lt., pf.—$7—no par.	99½	....	....
Southeastern Pwr. & Lt., pte. pf.	67	....	....
S. E. Pwr. & Lt., com.—no par.	29½	20	46½
So. Calif. Edison, 8% pf.—25.	32	32½	33½
So. Calif. Edison, 7% pf.—25.	27½	....	....
So. Calif. Edison, 6% pf.—25.	24½	....	....
So. Calif. Edison, com.	32	30½	33
Southern Cities Utilities, 7% pf.	85½	....	....
Southern Cities Utilities, com.	34	....	....
Southwestern Lt. & Pwr., A.	60	....	....
Southwestern Lt. & Pwr., B	60	....	....
Southwestern Lt. & Pwr., $6 pf.	83	....	....
Southwestern Pwr. & Lt., 7% pf.	k102½	100	105
Springfield (Mo.) Ry & Lt., 7% pf.	99	95	100
Standard Gas & Elec., 8% pf.	56½	53½	57½
Standard Gas & Elec., 7% pf.	103	....	....
Standard Gas & Elec., com.—no par.	56½	51	69
Standard Pwr. & Lt., 7% pf.	95	....	....
Staten Island Edison, pf.—$6—no par	96	....	....
Superheater, com.—no par.	158	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com	335	260	345
TAMPA ELEC., com.	50	....	....
Tenn. Elec. Pwr., 6% pf.	89½	....	....
Tenn. Elec. Pwr., 7% pf.	102½	....	....
Terre Haute, Ind. & East Trac., pf.	20	20	37
Terre Haute, Ind. & East. Trac., com	1	1	7
Tex. Pwr. & Lt., 7% pf.	l107½	102	106½
Tide Water Pwr., 8% pf.	102	....	....
Timken Roller Bearing, com—no par	63½	44½	63½
Toledo Edison, 8% pf.	l113	111	113
Toledo Edison, 7% pf.	l102½	101	103
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	86	87½	89
UNITED GAS & ELEC., 6% pf.	97	....	....
United Gas & Elec., com.—no par.	m 57	56	66
United Gas & Elec. (N.J.), 5% pf.	70	....	....
United Gas Impr.—50.	c112½	84½	144½
United Lt. & Pwr. pf.—$4—no par.	50	44	51
United L. & P. pf.—$6.50—no par.	87	81	91
United Lt. & Pwr., com., A—no par	a 15½	13½	26
United Lt. & Pwr., com., B—no par	a 20	15	31
Utah Pwr. & Lt., 7% pf.	l102½	99	103½
Utica Gas & Elec., 7% pf.	k104½	103	106
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A	m 30	28½	37
Utilities Pwr. & Lt., com. B—no par.	k 14	13½	18
VERMONT HYDRO - ELEC., 7% pf.	95	94	96
Virginia Elec. & Pwr., 7% pf.	104	101	105
Virginia Pwr., 7% pf.	108	102	104
Virginian Pwr., com.	70	65	75
WAGNER ELEC., pf.	b 68	61½	85
Wagner Elec., com.—no par.	b 17½	13½	34½
Washington Ry. & Elec., com.	j180	....	....
Washington Ry. & Elec., pf.	j 90½	....	....
Washington Wtr. Pwr., com.	133	130	136
West Mo. Pwr., 7% pf.	92	....	....
West Penn., 7% pf., temp. ctfs.	m100	95½	101
West Penn, com.	m125	118	130
West Penn Elec., pf.	100	95½	100½
West Penn Elec., Class A.	k 94½	88½	97
West Penn Pwr., pf.	m112	108	112
West Va. Lt., Ht. & Pwr., 7% pf.	94½	94½	98
West Va. Utilities, 7% pf.—50.	46½	42	50
Western Pwr., 7% pf.	96	91½	99
Western States Gas & Elec., 7% pf.	92	....	....
Western States Gas & Elec., com.	16	....	....
Westinghouse El. & Mfg., com—50.	70½	65	79½
Weston Elec. Instrument, Class. A.	k 31½	27½	32½
Weston Elec. Instrument, com.	17½	13½	19½
Wheeling Elec., pf.	92	91	97
Wis. Pwr., Lt. & Ht., 7% pf.	90	85	90
Worthington Pump, pf. A	k 64½	66	80
Worthington Pump, pf. B	k 57	53	65
Worthington Pump, com.	31½	20½	44½
YADKIN RIVER PWR., 7% pf.	l107½	102	107½
Yale & Towne, com.—25.	70	60½	72½

Stock Exchange: eChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Franacisco; iPittsburgh; jWashington. kBid, low, high, Saturday, Sept. 4. lBid, low, high, Wednesday, Sept. 8. mLatest quotations available.

structure was materially strengthened through the retirement of a part of its funded debt. Bonds now constitute 55 per cent of the total capitalization.

Public Service Company of Oklahoma to Consolidate Bonded Debt.—A banking group headed by Halsey, Stuart & Company, Inc., has purchased $4,750,000 Public Service Company of Oklahoma first mortgage 5 per cent bonds in a transaction that emphasizes the favorable opportunities for refinancing and the strengthening position of public utility bonds. Proceeds will be used to consolidate the company's bonded debt, consisting entirely of 6 per cent bonds, into the new issue of 5's, thereby effecting a considerable saving in interest charges. The company, a subsidiary of the Middle West Utilities Company, serves Tulsa and 28 other Oklahoma communities with electricity and does a large ice business. The bonds are due Sept. 1, 1961.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Allis-Chalmers Mfg., pf.	1¾	Oct. 15
American Public Service, pf.	$1.75	Oct. 1
Bangor Hydro-Elec., pf.	1¾	Oct. 1
Brazilian Trac., Lt. & Pwr., pf.	1¾	Oct. 15
Buffalo, Niagara & East. Pwr., com.	.25	Oct. 1
Buffalo, Niagara & East. Pwr., pf.	.40	Oct. 1
Elec. Pwr. & Lt., pf. allot. ctfs. 40% pd.	.70	Oct. 1
Midland Utilities, pr. ln.	1¾	Oct. 6
Midland Utilities, pf. A	1¾	Oct. 6
Northern Ohio Pwr. & Lt., 6% pf.	1¾	Oct. 1
Northern Ohio Pwr. & Lt., 7% pf.	1¾	Oct. 1
Utilities Power & Lt., cl. A	.50	Oct. 1
Westinghouse Elec. & Mfg., com.	$1	Oct. 30
Westinghouse Elec. & Mfg., pf.	$1	Oct. 15
Winnipeg Electric, pf.	1¾	Oct. 1

Trumbull-Vanderpoel Company Offers Preferred Stock. — Cumulative convertible participating preferred stock of the Trumbull-Vanderpoel Electric Manufacturing Company was offered to the investing public at $24 per share to yield 7.29 per cent. The issue involved 16,380 shares. Growth and expansion of the business has made necessary additional working capital which will be obtained from the sale of this issue.

Offers Exchange of Bonds for Preferred Stock.—The New York State Gas & Electric Corporation has secured for the holders of first mortgage 6 per cent gold bonds due Jan. 1, 1952, and first mortgage 5½ per cent gold bonds due Oct. 1, 1962, the privilege of exchanging the same into seven-dollar dividend series preferred stock of the Associated Gas & Electric Company upon the following bases: Eleven shares of said stock for each $1,000 principal amount of first mortgage 6 per cent gold bonds due Jan. 1, 1952, and ten and three-quarter shares of said stock for each $1,000 principal amount of first mortgage 5½ per cent gold bonds due Oct. 1,

1962, with cash adjustment for accrued interest and accrued dividends to the date of receipt of the bonds for exchange. By making this exchange the holder of a thousand-dollar 6 per cent bond will increase his return from $60 to $77, and the holder of a 5½ per cent bond from $55 to $75.25.

Barcelona Utility Reports Successful Year.—The annual statement of the Barcelona Traction, Light & Power Company for the year 1925 shows a substantial increase in both gross earnings and net profit. Total earnings amounted to $3,678,234 in 1925, as against $2,999,287 in 1924 and $2,726,973 in 1923. Gross earnings from the electric light and power business compared with the previous year increased 10.53 per cent. The net earnings showed a higher percentage of increase —13.86 per cent—the operating ratio having decreased 2 per cent, from 33.45 to 31.45.

To Redeem Bonds of Tennessee Power Company.—The National City Bank of New York, as trustee, has issued a notice to holders of the Tennessee Electric Power Company ten-year 6½ per cent debenture bonds of 1933 to the effect that the company is redeeming on Oct. 1 next at 100 and accrued interest $38,500 aggregate principal amount of the bonds, which have been designated by number. The drawn bonds must be surrendered on Oct. 1, the redemption date, at the head office of the National City Bank of New York, where they will be redeemed and paid out of sinking-fund moneys set aside for this purpose.

New York Edison Net Income in 1925 Nearly $15,000,000.—The New York Edison Company (including United Electric Light & Power Company) reports for the year ended Dec. 31, 1925, consolidated net income of $14,958,089, after fixed charges and taxes, compared with $14,814,496 in the preceding year. The comparative account is:

	1925	1924
Operating revenues	$69,867,089	$64,679,386
Operating expenses, etc.	43,856,286	39,571,133
Operating income	$26,010,803	$25,108,253
Other income	803,321	725,078
Total income	$26,814,124	$25,833,331
Taxes	6,630,831	6,171,732
Fixed charges	5,225,204	4,847,103
Net income	$14,958,089	$14,814,496
Dividends	12,500,235	10,074,263
Surplus	$2,457,854	$4,740,233

Engineers' Public Service Increases Shares.—At the annual meeting of the stockholders of the Engineers' Public Service Company held recently in Wilmington, Del., an increase of 500,000 shares in the common stock of the company was authorized. No change in the preferred stock was made, the total capital stock now authorized being 400,000 shares no-par-value preferred stock and 1,500,000 shares common stock, no par value. No immediate issue of this new common stock as authorized is contemplated.

Cities Service Company in July.—The gross earnings of the Cities Service Company for the twelve months ended July 31, 1926, were $21,883,727, as compared with $18,463,237 in the corresponding period of the preceding year. In the same twelve months net earnings amounted to $21,017,002, as compared with $17,702,264. Net to stock and reserves was $18,438,381, which is 3.23 times the preferred stock dividends as compared with $15,656,048 for the twelve months ending July 31, 1925, which was 3.04 times the preferred stock dividends. Net to common stock and reserves was $12,725,975.

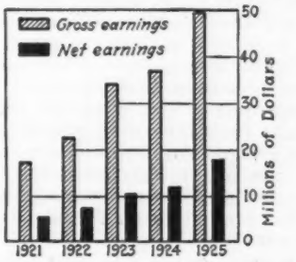
American Gas & Electric's Position

Annual Gross Earnings Now Reach Total of $68,500,000—American Electric Power Company Income Is Included in Figures for First Time

By Paul Willard Garrett
Financial Editor *New York Evening Post*

FROM total annual revenues of only $1,727,266 at the time the company began business in 1907 the American Gas & Electric Company has grown by steady gains to a utility that during the twelve months ended May 31, 1926, revealed gross earnings of $68,512,741. In a recent statement by this organization of its combined income the earnings of all subsidiaries, including the American Electric Power Company, which had not heretofore been included, were recorded.

The American Gas & Electric Company now operates in 791 different communities in New Jersey, Delaware, Pennsylvania, Virginia, West Virginia, Tennessee, Kentucky, Ohio, Indiana, Michigan and Illinois. Its principal subsidiaries are as follows: The Appalachian Electric Power Company, the Ohio Power Company, the Indiana & Michigan Electric Company, the Indiana General Service Company, the Rockford Electric Company, the Scranton Electric Company, the Wheeling Electric Company, the Atlantic City Electric Company and the Wilmington & Philadelphia Traction Company.



GROSS AND NET EARNINGS OF AMERICAN GAS & ELECTRIC COMPANY

As a result of the American Gas & Electric Company's efforts in tying together different properties it now has one of the largest interconnected superpower systems under one control in the world. The combined income statement for the twelve months ended May 31, 1926, showed gross earnings for the subsidiary companies of $68,512,741, and from this the income of the American Gas & Electric Company and the undistributed income of the subsidiary companies applicable to the parent, after reserves for renewals and replacements, left $15,561,551. Expenses of the parent company, including such things as interest, taxes and discounts on securities sold, reduced this amount by $2,013,218 to $13,548,333. Interest for the year on the funded debt of the American Gas & Electric Company aggregated $2,755,840, leaving a balance available for dividends of $10,792,493. Preferred-stock dividends took $2,328,881 of this sum, leaving in turn a total of $8,463,612 available for the common shares of the American Gas & Electric Company. That is equivalent to $6.57 a share on the 1,286,941 no-par value shares of the company outstanding.

While the word "gas" occupies an important position in the corporate name of the company, it is interesting to note that during the twelve-month period under review 89 per cent of the total gross earnings were derived from the sale of electric power and light services rendered by the American Gas & Electric Company.

On the latest available balance sheet of the company, that for May 31, 1926, $113,437,127 is shown as assets, of which $78,068,019 represents investments and $22,166,615 cash and call loans receivable. The balance sheet shows a surplus of $8,056,538. The capital structure of the American Gas & Electric Company is relatively simple, the parent having only two issues of bonds outstanding and two issues of stock. There is an issue of collateral trust 5 per cent bonds, amounting to $6,282,000, due in 2007, to be specific, and an issue of 6 per cent debenture bonds, amounting to $46,904,000, due in 2014. There are 396,432 shares of six-dollar preferred stock and 1,286,941 shares of common stock.

New Capital Issue

On Thursday of the past week the Shawinigan Water & Power Company offered in New York an additional issue of first mortgage sinking-fund gold bonds to the amount of $3,000,000, the price being 102½ and accrued interest, yielding over 4.80 per cent. These bonds are secured (subject only to 5 per cent consolidated mortgage bonds totaling $3,622,000) by direct mortgage on the company's lands, water powers, dams, power houses and transmission lines now owned, or hereafter acquired from the proceeds of first refunding mortgage bonds; by pledge of mortgage bonds and stocks of controlled distributing and manufacturing companies and by a "floating charge" on all of the other present or future assets of the company.

Manufacturing and Markets

Compromise Wiring Rules Adopted

Article 5 Committee Unanimously Recommends Acceptance of Compromise Rules for Non-Metallic Sheathed Cable—Prompt Action Assured by N.F.P.A.

AT ITS second meeting, held at Cedar Point, Ohio, last week, the Article 5 committee of the National Fire Protection Association, with all its members in attendance and also two alternates, unanimously subscribed to a proposed new text for Section 507, to be referred to the electrical committee for consideration and possible adoption as a substitute wording for the present Section 507. This section deals with the rules for the use of non-metallic sheathed cable. As reported in the June 19, 1926, issue of the ELECTRICAL WORLD, the non-metallic sheathed cable rules approved by the N.F.P.A. were allowed for tentative field application by the American Engineering Standards Committee, but returned with the request that a closer agreement be obtained between the minority and majority interests.

The text of the article committee's recommendation for an amended wording of Section 507 has been released by the executive office of the N.F.P.A. to the sectional committee for letter ballot. In the meantime the executive committee of the sponsor body is having the matter referred to it, also by letter ballot. Provided the outcome of these letter ballots indicates general support of the recommendation of the article committee with respect to the substitution of this new wording for that previously adopted for Section 507, the executive office of the N.F.P.A. will file an amended application with the A.E.S.C. in the expectation of early action by that body looking to the approval of the amended 1926 supplement.

In the report of the Article 5 committee, Chairman A. Penn Denton states that it is with a feeling of great satisfaction on the part of members of the committee on Article 5 that he was authorized to submit to the electrical committee a revised set of rules for Section 507. W. H. Blood, a member of the committee on Article 5, was not entirely satisfied with the original compromise rules, but because of the fact that it was his rules which were finally accepted by the electrical committee last February as its recommendation for the 1926 supplement, the committee was unanimous in agreeing to reconsider its previous action in order to try if possible to adopt some rules for the use of non-metallic sheathed cable on which all members could unanimously agree, and in turn to submit such rules to its own organization and recommend their acceptance.

The committee on Article 5 states in its report that it feels that the new rules are a fair and reasonable compromise which all parties at interest can accept. Harmony has thus been established on this controversial subject, and the committee believes that these rules will be accepted as a satisfactory compromise, which will in turn permit of obtaining complete agreement on this subject at the next annual meeting of the electrical committee.

These revised compromise rules for non-metallic sheathed cable are different from the original rules, submitted under date of Aug. 9, only in the matter of omitting the two-family residence under certain conditions of use, and providing it may be used for all circuits in all residence occupancies. In view of this change the committee felt that it was important to recommend to the Underwriters' Laboratories the use of this cable in sizes No. 14 to No. 6, inclusive, both two and three-conductor assemblies. This one additional size over that approved by the laboratories at this date will permit of circuits for range wiring in those residences wired for lights and appliances with non-metallic sheathed cable.

The compromise rules as agreed upon by the committee on Article 5 are as follows:

(a) Cable shall not be used for circuits exceeding 300 volts between conductors.

(b) Cable shall not be used except for all circuits in residence occupancies and in outbuildings on the same premises where other types of wiring are not required by this code.

(c) Shall be of approved types and of two and three conductor assemblies in sizes Nos. 14 to 6, inclusive.

(d) May be used in exposed wiring work under the following conditions:

(1) Shall be mounted directly upon surfaces of woodwork, plaster, cement, brick or other building finish.

(2) Shall be secured between outlets with approved fastenings spaced at intervals not exceeding 4 ft.

(3) Shall be used only in dry places and in no place run along the wall nearer than 6 in. above the floor.

(4) Shall be protected within 5 ft. of floor by wood or metal protecting strip placed over the cable and securely fastened in place.

(e) May be used in concealed wiring work under the following conditions:

(1) Shall be used only in dry places; in wood joist or stud partitions, floors and walls.

(2) When non-metallic sheathed cable is used for concealed wiring, it shall be secured between outlets by approved fastenings spaced at intervals not exceeding 4 ft. or by other practicable means which will provide for the entire installation being securely fastened in place.

(3) Where it is impracticable in concealed wiring to provide the supports specified in the preceding paragraph, runs of non-metallic sheathed cables may be fished between the outlet boxes or plates.

(f) Shall be run without joints, splices or taps from outlet box to outlet box (or junction boxes or plates).

(g) Shall be provided with approved outlet (or junction) boxes or plates at each outlet, into which the cable shall be run and to which it shall be rigidly fastened by means of approved fittings, which completely close the opening. If cable enters boxes from the side in concealed work, boxes of 1½ in. depth are required. (It is recommended that for all side wall and partition outlets in concealed work in buildings under construction outlet boxes having a depth of approximately 1½ in. be used.)

(h) All bends shall be so made and other handling shall be such that the non-metallic covering of the cable will not be injured.

(i) Shall not be buried in plaster, cement or similar finish.

(j) When non-metallic sheathed cable is installed in conduit the provisions of Section 503 of this article shall apply as far as practicable.

(k) When in exposed or in concealed wiring, non-metallic sheathed cable is run through holes in studs, joists or similar wood members, the holes shall be located at the approximate center of studs and not less than 2 in. from the nearest edge of joists or other members whose depth permits this spacing.

(l) In attics and roof spaces where within 5 ft. above floor or joists the cable shall be considered as exposed to mechanical injury, and shall be protected by suitable wood or metal strips securely fastened in place. Cable shall not be used across top of joists in unfinished attics or roof spaces, nor in similar locations.

(m) Cable in basements, if used in other than concealed work, shall be run on under side of running board, not less than ¾ in. by 2 in., or on side of floor joists or timbers.

Increased Market for Appliances in Netherlands

A larger market for modern electrical household appliances has recently been created in the Netherlands as a result of the activities of the Municipal Electric Works at Amsterdam, and, since American products are generally favored by the Dutch public, the local business possibilities for American manufacturers are believed to have improved, according to a report to the Department of Commerce from the office of the Trade Commissioner, The Hague, Netherlands.

Electricity is available even in most of the rural districts and smaller villages. Alternating current at 50 cycles is generally used, some systems operating at 220 volts and others at 125 volts. The general application of electrical appliances has been restricted, owing to the comparatively high rates, but special rates are now being quoted, and increased sales of electric household appliances have resulted from this reduction in rates combined with a systematic advertising program.

Berlin Plans Appliance Campaign

Plans for making concentrated efforts toward the introduction of electrical household appliances and apparatus in Berlin, Germany, are under way. Realizing the superiority of American-made apparatus in this particular field, it is intended to base this campaign on American practices in making similar campaigns, and it is also planned to import such apparatus from America as may either be unknown in Europe or may be considered of superior quality.

Business Conditions

SEVERAL large orders placed by central-station companies, industrial plants and railroads were prominent among the sales made in the industry. A 208,000-kw. turbo-generator set was ordered by a utility company in Illinois, and another company in the same state and controlled by the same interests executed a contract for a 104,000-kw. turbo-generator set. These contracts involve an expenditure of more than three million dollars. A large rolling-mill equipment order amounted to $200,000, and a rapid-transit system purchased $175,000 worth of motors and control.

Industrial plants are steady buyers of general-purpose motors. Orders for that commodity to date are ahead of sales for the same period last year. Heavy buying of switching equipment and control apparatus was reported, with sales in one district totaling over $750,000. Negotiations reported under way in various sections of the country indicate an active business throughout the rest of the year.

In New England large orders placed were a feature of trade. One for heavy rolling-mill equipment amounted to $200,000 and another called for $175,000 worth of motors and control for cars of the Boston rapid-transit system. Small motors are also in steady demand. Sales of switches and control apparatus by a large manufacturer total over $750,000, and heavy buying is reported for Southern power plants. Utility companies have become more active in the New York district, with pole-line hardware in especially good demand. An order for $30,000 worth of switching equipment was also placed, and negotiations under way cover a large amount of similar apparatus. In the Southeast textile-mill electrification is active, and appliance and range sales are particularly good owing to the extension of transmission and distribution systems. Sales in the St. Louis district exhibit a steady trend, with a slight improvement in the demand for construction material, poles and transmission-line hardware. A good-sized volume of business is pending in the Southwestern part of the district, and it is expected to materialize within the next 30 to 60 days. Business continues steady in the Middle West, and there has been good sales of cable, weatherproof wire and various kinds of distribution equipment. On the Pacific Coast lumber and shingle mills are active buyers and a number of motors were purchased. Sales during August were not so high as anticipated but were in good volume.

Small Volume of Sales Recorded in Non-Ferrous Metal Market

Sales of the non-ferrous metals have been extremely light owing to the holidays. Last week Friday sales of copper and zinc were fairly active, but business this week has been extremely dull, with consumers apparently waiting to see if sellers will get tired of waiting and reduce their prices. So far most sellers have held firm at recent levels.

Though the American Smelting & Refining Company continues to quote New York lead at 8.90 cents and is satisfied to have the demand quiet for a time, other sellers have offered lead as low as 8⅝ cents. Not a great deal has been sold at any price, though the outside sales have been enough to bring quotations slightly below the Smelting company's price, at which a good tonnage of lead continues to go out on contracts. The concessions have been made largely by dealers with London connections or by producers anxious to sell a small tonnage for what it will bring. Sales of zinc have been in fair volume. On Friday last week a little was sold at 7⅛ cents, but most of the business was done at 7.40 cents and 7.425 cents. Prompt Straits tin reached a new high for the post-war period on Wednesday, when 67½ cents was quoted. London has been very firm on account of short supplies, the high price here being a reflection of the English quotation. Consumers have shown little interest in the market, though some have been forced to buy small tonnages.

NEW YORK METAL MARKET PRICES

	Sept. 1, 1926 Cents per Pound	Sept. 8, 1926 Cents per Pound
Copper electrolytic	14.40	14.325
Lead, Am. S. & R. price	8.90	8.90
Antimony	15⅛	15⅛
Nickel, ingot	35	35
Zinc spots	7.75	7.75
Tin, Straits	66⅛	67½
Aluminum, 99 per cent	27½	27

Base copper price Sept. 8, 1926, 16¼ cents.

Lumber and Shingle Mills Active Buyers on Pacific Coast

Power-company purchasing on the Pacific Coast has included two carloads of clay conduit, 50,000 pole steps, 600 square-sawed poles, 5,000 porcelain insulators, 6,000-volt type, and 100 large wire grips for new construction work. Railroad purchasing has included 50,000 ft. of assorted ⅜-in. and 7/16-in. strand wire and about 35,000 lb. of galvanized tie wire. State business is limited to small maintenance orders. Dealer business is better with a good percentage of sizable stock orders. A Fresno dealer has purchased 350 assorted heating devices, largely small radiators. Industrial sales have included 15,000 bakelite plugs for a manufacturer of heating devices, an order for $15,000 worth of wiring supplies and motors for a Petaluma incubator company, several arc-welding outfits for various oil and steel companies, averaging $1,000 each, a portable arc-welding outfit for a railroad company costing about $2,500, eight mechanically driven turbines, each 150 hp., for an industrial plant, and 25 motors in 35-hp. and 50-hp. sizes, for an oil company for use in oil-well drilling.

With the exception of sales to lumber and shingle mills, industrial buying in the northern section of the Pacific Coast was not active. Specifications are now in the hands of bidders for an initial order of about $30,000 worth of motors for a pulp and paper company at Shelton, and a contract was signed by a Seattle jobber for 30 motors ranging from 75 hp. down for another pulp and paper company at Edmonds, near Seattle. Buying by lumber mills was fair with individual orders small. The largest order placed was for 25 motors from 50 hp. down for a cedar mill in Mason County. A gypsum plant is also in the market for several motors. The movement of poles, cross-arms and hardware is comparatively light owing to the various central-station companies having virtually completed their expansion programs for the year. An increased movement of electric heating devices is noted by the local manufacturers and jobbers, and the volume of lamp business is reviving.

Utility Companies More Active in New York District

Quite a noticeable increase in buying by public utility companies in the New York district has been apparent in certain lines since the first of this month. Pole-line hardware particularly has become active during the past week, and the good demand is owing to the number of orders received rather than to the magnitude of individual orders. Several railroad companies are included among the purchasers in this field. Poles, cross-arms and insulators have also shown some improvement during the past week. Switching equipment is fairly strong, one order for about $30,000 worth of this material having been placed within the last few days, and it is expected that other orders, for which negotiations are now under way, will be closed within a week. Transformer sales are quiet, with no indications of any appreciable change in their status in the immediate future. Industrial activity remains practically unchanged, the demand for motors up to 10 hp. and control equipment continuing strong.

Textile Mill Electrification Active in Southeast

With the advent of the fall season, quickened activities are to be noted in all lines in the Southeast, with electrical interests reporting business generally satisfactory and the outlook for the next few months as most encouraging. Construction is about to start on a textile mill for which motors, transformers and wiring supplies amounting to more than $30,000 will be required. There are several small industrial electrification jobs under way, and a considerable amount of textile and small commercial business is in prospect, contracts on which have been anticipated for more than 60 days and which should now materialize at any time.

Electric appliance and range business continues good, with the sales increases in appliance lines running ahead of the ranges at this time. While the activity is general over the Southeast, it is particularly strong in Georgia on account of the extension of transmission and distribution systems. As considerable development work is yet to be under-

taken, sales of practically all electrical equipment should show steady increases in that state for some time to come. Very satisfactory electric water heater sales are reported for Florida, and the demand for heavy duty electrical appliances is normal, one job having been recently closed for a complete electrical installation in a country club in Arkansas. A large power company in Georgia has just completed a six weeks' electric refrigerator campaign in which units totaling more than $154,000 were sold. While electric truck sales are quiet, orders have been recently closed for one commercial truck for Atlanta, two for Memphis and an industrial truck for Birmingham delivery. Some very satisfactory business is reported in batteries for the operation of railway automatic signal systems, the largest single order during the past two weeks amounting to $12,000. Telephone battery sales have been good all year and satisfactory orders have lately come in from Georgia, Tennessee and South Carolina cities. Renewal batteries for electric street trucks are also in steady demand.

Sales in St. Louis District Exhibit Steady Trend

No marked change has been noted in conditions prevailing in the St. Louis district. There has been a slight improvement in the demand for construction material, poles and transmission line hardware. There has been no spectacular business placed, but the regular buying which has been previously noted is continuing and is keeping this year's sales above those of last year. An order for six generators with switching equipment, amounting to approximately $12,000, was placed by one of the large oil pipe line companies operating in Illinois and Indiana. There is a good-sized volume of business pending in the southwestern part of the district, and this is expected to materialize within the next 30 to 60 days. The demand for all electrical merchandise continues steadily, and several fairly good orders for transformers and meters have been shipped, although central-station and industrial orders have been a little slow in coming in the past week.

Large Orders Feature Business in New England District

Several large orders which have been pending in the New England district are announced and are promising forerunners of what is predicted to be a favorable trend in buying during the last quarter of this year. Heavy rolling-mill equipment amounting to about $200,000 has been purchased by a central Massachusetts steel and wire company, and motors and control for reconditioning cars of the Boston rapid transit system, amounting to about $175,000, have been ordered recently. The movement in small motors is also steady, and the volume to date as compared with last year shows a substantial increase. Central-station supplies are in good demand and numerous orders are reported. One manufacturer has recorded sales of switches and control apparatus which total over $750,000, and another company reports heavy buying for Southern power plants and notes one order amounting to about $40,000 as well as several smaller ones.

New construction supplies are also in demand, and contractors are interested in wiring supplies, sockets, fiber conduit and cable. Industrial heating activities are increasing, both from the standpoint of the volume of inquiries and from the number of sales. Recently two 40-kw. lead pots were placed in southern New England and orders for several more are expected at an early date. Household appliance sales are steady wtih ranges and refrigerators outstanding in interest. Construction awards continue to meet a high level, labor conditions are satisfactory, and new construction is moving rapidly with indications of continued activity for some time to come.

Activities of the Trade

Lighting Equipment Companies Plan National Exhibition

The Artistic Lighting Equipment Association, formerly the National Council of Lighting Fixture Manufacturers, is completing plans for the largest and most elaborate display of lighting equipment ever undertaken by the industry. The display will embrace fixtures, wall brackets, floor, bridge and table lamps, metal furniture, industrial and commercial lighting units, illuminating glassware, shades, lighting equipment, accessories and parts and supplies of all kinds. These displays and demonstrations will be a part of the National Exhibition to be held at the Hollenden Hotel, Cleveland, Jan. 31 to Feb. 5, next, inclusive.

Originally, this educational display was designed for the benefit of the dealer, architect, builder, jobber and electrical contractor, but at this exhibition on certain hours and days the display will be thrown open to the public. It is planned by the National Association of Lighting Equipment Dealers to hold its meeting and convention at the same time and place.

Allis-Chalmers Unfilled Orders at Highest Point in Four Years

Unfilled orders of the Allis-Chalmers Manufacturing Company amounted to $13,409,000 and is the highest point reached by that company in the last four years. The previous high record was March 1, 1921, when unfilled orders amounted to $14,118,000 as the peak of a four-months buying move. On Jan. 1, 1926, unfilled orders amounted to $10,100,000. No exceptionally large orders have contributed to this steadily increasing volume of business, the gain being almost entirely owing to frequent small orders that were well distributed in the various departments. The company states that there is a fair outlook for business during the rest of the year.

Westinghouse Creates New Circuit-Breaker Department

A new department under the direct management of J. B. MacNeill, electrical engineer, is to be created at the Westinghouse Electric & Manufacturing Company's plant, according to an announcement made recently by W. S. Rugg, vice-president. The new department, to be known as the circuit-breaker engineering department, is a direct outgrowth of the immense increase in production during the past year of air and oil circuit breakers, air-break switches and high-voltage fuses. It is stated by Mr. Rugg that sales of this apparatus ran well over $12,000,000 last year. The new department, under Mr. MacNeill's direction, will be concerned chiefly with new designs of circuit breakers and the development of new types. Experimental work with all types of switchings will come also under the jurisdiction of this new section.

The Burke Electric Company, Erie, Pa., manufacturer of motors, generators and welding equipment, announces the appointment of E. I. Van Doren, 206 Times Building, Troy, N. Y., as district sales agent.

The Kuhlman Electric Company, Bay City, Mich., manufacturer of power, distribution and street-lighting transformers, announces the opening of a direct factory branch office at 411 Glenn Building, Atlanta, Ga. The office is in charge of Ernest K. Higginbotham, who for the past two years has represented the Kuhlman company throughout the Southeast.

The A. J. Lindemann & Hoverson Company, Milwaukee, announces that it is now offering the new L. & H. electric air heater in two sizes—a 16-in. and a 28-in. unit. The smaller type is made for 115-125 volts or for 220-230 volts and can be had in 1,000, 2,000 and 3,000-watt sizes, while the larger types are built for 220-230 volts only in 4,000, 5,000 or 6,000-watt units.

The Bakelite Corporation, 247 Park Avenue, New York, has filed plans for the erection of a new two-story addition at its Bloomfield (N. J.) plant, 100 ft. x 131 ft.

The Roller-Smith Company, 233 Broadway, New York City, announces the appointment of the Robinson Sales Company, Polson Building, Seattle, Wash., as its sales agent for the state of Washington and most of the state of Oregon. The Robinson company has been previously handling Roller-Smith apparatus on a sub-agency basis for some time. The Ashida Engineering Company, Ltd., Daini, Osaka, Japan, has also been appointed agent for Japan (including Korea and Manchuria).

The American Brown Boveri Electric Corporation, 165 Broadway, New York, is planning extensions in its Camden (N. J.) plant, utilizing properties secured at the time of the original acquisition but not used heretofore in connection with current operations. The land primarily comprises what is known as the South Yard, located on the

Gloucester side of Newton Creek. Alterations and improvements will be made in existing buildings and the necessary equipment installed. It is understood that the expansion will be used largely for the production of turbo-generating units.

The Bristol Company, Waterbury, Conn., manufacturer of recording pressure gages, thermometers, pyrometers and other instruments, announces the opening of a branch sales and service office in the U. S. National Bank Building, Denver, in charge of H. T. Weeks.

The American Engineering Company, Philadelphia, has received an order from the Società Generale Italiana Edison di Elettricità at Genoa, Italy, for six Taylor stokers.

The Circle F Manufacturing Company, Trenton, N. J., manufacturer of electrical and porcelain specialties, has appointed B. H. Clifford, 3201 Twelfth Avenue, N., Birmingham, to handle its line of wiring devices in the states of Alabama, Arkansas, Mississippi, Tennesseee west of Nashville, and Louisiana.

The Illinois Electric Company, Los Angeles, jobber, has opened a branch office at 712 Electric Building, San Diego, Cal. R. P. Wakeman, who has been associated with the Los Angeles branch for the last three years, is in charge.

The Walter Bates Steel Corporation, Gary, Ind., manufacturer of steel towers, poles, substations and other steel products for utility companies, announces that it now has established the following representatives: Lee Skipwith & Company, Inc., 50 Church Street, New York City; the E. S. Stickle Company, 40 W. Seneca Street, Buffalo, N. Y.; the Continental Sales & Engineering Company, 839 Oliver Building, Pittsburgh; the E. S. Stickle Company, 342 Rockefeller Building, Cleveland, and E. A. Thornwell, Candler Building, Atlanta, Ga. The company also announces that the Wonham Bates & Goode Trading Corporation, 44 Whitehall Street, New York City, has been appointed export representative.

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, manufacturer of electrical measuring instruments, has completed plans for the erection of a new addition to its plant.

The Transelectric Company, 360 North Michigan Avenue, Chicago, manufacturer of transmission and distribution equipment and live-line maintenance tools, announces that since Sept. 1 its Chicago office has been under the management of Brent Mills.

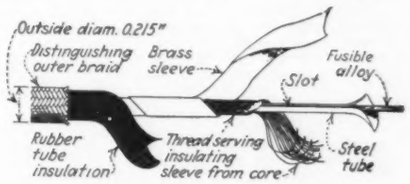
The Westinghouse Electric & Manufacturing Company has received an order from the Southern California Edison Company for switching equipment consisting of two broad-range regulators for the automatic control of generator voltage; four type 0-44 11,000-volt oil circuit breakers, and one 187,000-volt, outdoor-type G-22 breaker for use on a 220-kv. solidly grounded neutral system. This equipment was included in the order placed with the company for the largest horizontal waterwheel generators, which was announced in the July 24 issue of the ELECTRICAL WORLD.

New Equipment Available

Fire-Detecting System

A fire-detecting system using a special automatic continuous thermostatic wire has been placed on the market by the Garrison Fire Detecting System, Inc., 79 Madison Avenue, New York City. The wire, as shown in the illustration, is of the concentric type. The inner wire consists of a fusible alloy protected by a steel tube having a lateral slot. When the temperature of the wire is raised the alloy melts, expands and spurts through the slot in the steel tube, permeating the insulating threads between the conductors and contacts with the brass sleeve or outer conductor, thus closing a circuit, and giving an alarm.

The system operates on the closed-circuit principle and is thus under constant electrical supervision. It is adaptable to meet every requirement from the small dwelling to the largest industrial plant. It is not dependent on any outside source of power as it utilizes a double set of storage batteries for



FIRE-DETECTING WIRE USED IN GARRISON FIRE-DETECTING SYSTEM

its operation, which batteries are also under supervision. All the component parts of the system are made by well-known manufacturers. For instance, the special fire-detecting wire is made by the Okonite Company, the batteries by the Electric Storage Battery Company, the relays by the Western Electric Company, the panels by the Bakelite Corporation; the gongs, transmitters and contactors are made by the Samson Electric Company, and the meters by the Weston Electrical Instrument Corporation. The Garrison fire-detecting system has been approved by the laboratories of the National Board of Fire Underwriters and Associated Factory Mutuals.

Material-Handling Equipment

An apparatus for elevating bulk materials, known as the Beaumont skip lift, has been developed by the R. H. Beaumont Company, 319 Arch Street, Philadelphia. The skip lift consists of only a bucket, guides, cable and electrically operated winding machine. Two distinct applications can be made with the skip lift, one where the elevating is to be done adjacent to a building, the guides being supported by the building wall, and the other where the material to be elevated is in isolated locations and the skip lift is of the self-supporting type. Three methods of operation are possible with the skip lift, full automatic, semi-automatic and manual.

The automatic type is equipped with the patented "Simplex" automatic loader, which is not dependent on electrical timing devices for operation. It is opened and closed only by contact with the skip bucket. The skip lift is adaptable for use at power plants, gas houses, steel mills, sand and gravel plants and industrial plants in general. It is said to be especially valuable at the smaller-sized power plant where moderate hourly capacity is required, and the same machine can readily handle coal and ashes.

Definite Time Relay

A definite time relay for operation on direct-current circuits has been designed by the General Electric Company. This is made in two forms, designated as type MC-12, one for 115-volt operation and the other for 230 volts. The new relay is designed to operate within a range of from 5 seconds, minimum, to 35 minutes, maximum. An extra lead is brought out through the enclosing case for connecting to the necessary resistor. A resistor mounted inside the case is connected in multiple with the motor armature to give constant speed.

Oil Circuit Breakers

A new line of oil circuit breakers designed for either indoor or outdoor service on systems of relatively large capacity has been developed by the General Electric Company. These are available in sizes of 400, 600, 800 and 1,200 amp. and voltages of from 15,000 to 88,000, inclusive. They are known as the type FK-236 and FHK-236. The breakers, which are rated at 73,000 volts or less, may be used up to altitudes of 10,000 ft. The 88,000-volt breakers are equipped with "high-altitude" bushings when used above 4,000 ft. The range of interrupting capacities for the FK-236 breakers is from 2,000 amp. to 7,000 amp., and from 3,300 amp. to 14,000 amp. for the FHK-236 type.

Each triple-pole breaker is made up of three single-pole, single-throw units operated by a single mechanism. This mechanism may be manually operated or electrically operated by either a solenoid or a motor. Unit mechanisms are totally inclosed within the breaker frame and are, therefore, freed of any tendency to reclose under the action of unbalanced internal pressures which may be set up when opening under abnormal conditions. A larger air space is thus also provided with consequent increase of interrupting capacity. Of the two forms, the type FK-236 uses finger and blade contacts, while the type FHK-236 is equipped with plunger or rod type contacts and explosion chambers. With explosion chambers higher interrupting capacities are obtained, although the manufacturer states that both types are adequate for the service for which they are rated.

New Trade Literature

INDUSTRIAL LIGHTING EQUIPMENT.—Instructions for planning industrial lighting installations, together with a worked-out typical problem, are explained in the first pages of the 31-page catalog on industrial lighting equipment issued by the Westinghouse Electric & Manufacturing Company. This catalog, No. 47-A, describes various types of industrial lighting equipment, and contains diagrams showing mounting height and spacings of lamps, signboard illuminating data, and other tables.

MANUAL CONTROLLERS. — Bulletins 106, 107 and 108 issued by the Clark Controller Company, Cleveland, describe respectively the type F, form D dynamic braking direct-current units, the type F, form R alternating-current controller and the No. O, type F, form R plain reversing controller. The bulletins contain complete dimension diagrams and ratings.

FIRE-DETECTING SYSTEM.—The Garrison fire-detecting system is described in a booklet issued by the Garrison Fire Detecting System, Inc., 79 Madison Avenue, New York. A completely illustrated description is given of the fire-detecting wire, an automatic, continuous thermostatic wire, and the other component parts of the system are also illustrated and described.

STOKER. — The Coxe traveling grate stoker is described in catalog C-4 issued by the Combustion Engineering Corporation, 43 Broad Street, New York. A brief history of the development of the Coxe stoker is included and the description of the stoker is supplemented by illustrations of actual installations. A curve depicts the Coxe stoker performance and a series of typical evaporative tests are included covering different makes of boilers and various grades of fuel.

INSTRUMENTS.—"Frequency Measurement and Control" is the title of bulletin No. 985 issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia. The bulletin deals with the problem of accurate frequency control and describes and illustrates the L. & N. frequency recorder. A reproduction of a frequency chart is attached to the bulletin.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

STAFFORD SPRINGS, CONN. — The Cyril Johnson Woolen Company will soon begin the construction of a hydro-electric power station at its mill, consisting of turbo-generator, exciter, switchboard and accessories.

BOSTON, MASS.—The Quincy Cold Storage Warehouse Company, 133 Commercial Street, is having plans prepared for a four-story, 75 ft. x 150 ft. power house, to cost with equipment $1,000,000. F. L. Fairbanks, engineer, is in charge.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company has plans to remove all overhead transmission wires in Monument Square, to include also the feed wires to the Worcester Consolidated Street Railway Company. The system will be changed to underground. Plans are being developed for the installation of 60 ornamental lights with metal poles in that section for a white way.

WILLIAMSTOWN, MASS. — The City Council has approved the construction of a transmission line from North Adams, Mass., and work will soon begin. Electric power will be furnished by the North Adams Gas Light Company.

GRANVILLE, MASS.—The voters of the town have decided to go ahead with the plans for thee construction of an electric light plant and to provide street lights and house lighting.

HOLYOKE, MASS.—The Germania Mills has plans for a new power house at its textile mills, installation to include two 600-hp. boilers, stokers and auxiliary equipment. The plant will cost about $65,000. McClintock & Craig, 458 Bridge Street, Springfield, Mass., are engineers.

GOFFSTOWN, N. H.—The Keene Gas & Electric Company has filed a petition with the Public Service Commission asking permission to install a transmission line between here and Dover. A hearing has been for Sept. 15.

Middle Atlantic States

WASHINGTON, D. C.—Sealed proposals will be opened in the supervising architect's office, Treasury Department, at 3 p.m., Sept. 24, 1926, for remodeling the electric passenger elevator, in the United States post office and court house, Ogden, Utah. Specifications may be obtained in the discretion of the supervising architect. James A. Wetmore is acting supervising architect.

BALTIMORE, MD. — Plans have been made to install an ornamental lighting system on Mount Royal Avenue from North Avenue to Oliver Street and on the streets around Patterson Park. Also the erection of a number of electric traffic signals on Mount Royal Avenue, between North Avenue and Cathedral Street.

SALISBURY, MD.—The Eastern Shore Gas & Electric Company is said to be planning the early construction of a new generating plant in the Del-Mar Peninsula section, with initial output of about 10,000 kw. The work will be carried out in connection with an expansion and improvement program reported to cost in excess of $1,000,000. New transmission lines will form a feature of the work.

ATCO, N. J.—Plans are under consideration for the installation of new lights in various parts of the town.

PAULSBORO, N. J. — The Edward G. Miller Mill & Lumber Company, Broad Street, contemplates the installation of electric power equipment in connection with the proposed rebuilding of the portion of its plant recently destroyed by fire with loss reported at close to $175,000.

SOUTH AMBOY, N. J.—Plans are under way for the installation of an ornamental lighting system on Broadway. The work will probably be carried out by the Jersey Central Power & Light Company. The South Amboy Business Men's Association is at the head of the project.

TRENTON, N. J.—Application has been made by the Public Service Gas & Electric Company and the Bucks Falls Electric Company, the latter a subsidiary of the Philadelphia Electric Company, for permission to erect a 132,000-volt transmission line over the Delaware River at Biles Island.

ALBANY, N. Y.—The Public Service Commission has authorized the construction by the Walkill Valley Electric Light & Power Company of an extension to its electric plant for furnishing electricity in that portion of the town of Shawangunk, Ulster County, which lies to the west of the line beginning on the northern boundary of the town of Shawangunk at the apex formed by the southern and southwestern boundaries of the town of Gardiner, running southeasterly to a point where the southern boundary line of the town of Shawangunk departs easterly from Shawangunk hill as agreed upon between the Walkill Valley Electric Light & Power Company and the Central Hudson Gas & Electric Company.

MIDDLE VILLAGE, N. Y.—The Metropolitan Resources, 111 Broadway, N. Y., has plans for a steam power house to cost about $240,000 with equipment. Lockwood, Green & Company, 100 East 42d Street, N. Y., are engineers.

BATAVIA, N. Y.—In connection with the proposed acquisition of the Western New York Utilities Company, the Buffalo, Niagara & Eastern Power Corporation, Buffalo, N. Y., is said to be planning for early extensions in transmission lines.

GREENPORT, N. Y.—The City Council has preliminary plans under way for the early erection of an extension to the street lighting system throughout the city, to include the installation of ornamental lights in various parts of the town. It is also planned to increase the candlepower of the lamps used in the outlying districts of the city limits.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company, C. S. White, Room 344, 466 Lexington Avenue, purchasing agent, until Sept. 24, for furnishing, delivering and erecting synchronous converters, air-blast transformers and other auxiliary substation

ROCKVILLE CENTER, N. Y.—The Village Board is negotiating for the purchase of the old power plant of the former Long Island Traction Company, to be used as a site for a proposed municipal power plant.

GALTON, PA.—The village Board is reported as considering the installation of an ornamental lighting system in the business section.

PHILADELPHIA, PA.—The Department of City Transit, 1211 Chestnut Street, plans the installation of electric power equipment in its proposed one- and two-story repair shops for the Broad Street Subway at the Fern Rock Terminal Yards, reported to cost in excess of $150,000.

PHILADELPHIA, PA.—The Leeds & Northrup Company, manufacturer of pyrometers and other electrical measuring instruments, 4901 Stenton Avenue, is asking for bids on a general contract for an addition to its plant to cost in excess of $50,000.

PITTSBURGH, PA.—The Suburban Electric Development Company, 5620 Penn Avenue, has filed plans for the erection of an addition to its local plant to cost $154,000, with machinery and equipment installations.

ROCHESTER, PA.—Plans of the Guaranteed Liquid Measure Company for the erection of a one- and two-story addition to its local factory building at a cost of $400,000 include the installation of considerable electrically operated machinery and equipment.

SHAMOKIN, PA.—The Shipman Coal Company, operated by Weston Dodson & Company, Bethlehem, Pa., plans the installation of electric power equipment in connection with extensions and improvements at its properties. A portion of an $800,000 bond issue will be used for the work.

YORK, PA.—The Pennsylvania Gas & Electric Corporation is disposing of a preferred stock issue of $1,000,000, a portion of the proceeds to be used for expansion. H. A. Clarke is president.

MARTINSVILLE, VA.—The Craig Furniture Company contemplates the installation of electric power equipment in its proposed local plant, on 15-acre tract recently acquired, estimated to cost $160,000. George D. Craig is head.

NORFOLK, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 21, for power distribution panel boards (Schedule 5935).

RICHMOND, VA.—The Eastern Utilities Corporation, Chicago, Ill., is seeking a franchise and expects to run an electric line through the county of Gloucester, Va.

North Central States

JEFFERSON, IOWA—The general contract has been awarded to H. L. Corey & Company, Aberdeen, S. D., for municipal light and power plant to cost $15,000.

MISSOURI VALLEY, IOWA—The Iowa Service Company will soon begin erection of a new steel service station on a five-acre tract recently acquired, south of the town. The company is also building a high-power line to Blairs, connecting with Nebraska towns.

SIBLEY, IOWA. — The Northwestern Light & Power Company is said to have purchased a local site and contemplates the construction of a power plant in the near future, reported to cost in excess of $75,000. Don V. Wells, superintendent, is in charge.

MADISONVILLE, KY.—The Kentucky Utilities Company, Louisville, Ky., has preliminary plans under way for the construction of a substation on local site, to be operated in connection with a proposed new 33,000-volt transmission line. A transmission line will also be built from Fredonia to Greenville.

DETROIT, MICH.—The Copeland Products Company, 630 Lycaste Avenue, manufacturer of electric refrigerating equipment, is considering plans for a one-story addition to cost about $50,000 with equipment. E. J. Browne is vice-president.

CASS LAKE, MINN.—The Minnesota Electric Light & Power Company, Bemidji, Minn., has contracted with the city for the installation of an ornamental lighting system in a portion of the downtown district.

FERGUS FALLS, MINN.—The Otter Tail Power Company will extend power line to Alexandria, Minn.

HASTINGS, NEB.—The City Council is considering preliminary plans for a one-story addition to the municipal electric light and power plant, 42 ft. x 74 ft., to include the installation of additional equipment. John G. Mason, 525 South Thirteenth Street, is engineer.

PLATTSMOUTH, NEB.—The Nebraska Gas & Electric Company will build a high voltage line from Omaha to Plattsmouth.

DICKINSON, N. D.—Work will soon be started by the Hughes Electric Company on a power line between Dickinson and Belfield.

JAMESTOWN, N. D.—The Northern Utilities Corporation a subsidiary of the Central West Public Service Company, Milwaukee, Wis., plans the construction of a 40,000-volt transmission line to serve its properties west of this city, supplying the village of Cleveland, Medina, Dawson, Steele, Streeter, Gackle and surrounding territory a distance of approximately 75 miles.

MILNOR, N. D.—The Otter Tail Power Company, Fergus Falls, Minn., has secured permission for the construction of a transmission line to Milnor and vicinity.

ROLLA, N. D.—The local power plant of the Rolla Light & Mill Company has been acquired by new interests, headed by Alfred Erickson.. Tentative plans are under consideration for extensions and betterments.

ALLIANCE, OHIO.—The Alliance Fertilizer Company plans the installation of electric power equipment in connection with the proposed rebuilding of the portion of its plant recently destroyed by fire with loss reported at close to $100,000.

MARIETTA, OHIO.—The Safe Cabinet Company plans the installation of electric power equipment in a proposed four-story addition, estimated to cost $170,000, for which superstructure will soon begin.

TOLEDO, OHIO.—The Champion Spark Plug Company plans the installation of electric power equipment in a proposed factory addition, estimated to cost $200,000.

BRITTON, S. D.—The South Dakota Utilities Company a subsidiary of the Central West Public Service Company, Milwaukee, Wis., contemplates the immediate construction of a transmission line between Britton and Amherst.

DOLAND, S. D.—The High Line Electric Company will build an electric line between Doland and Turton.

FLANDREAU, S. D.—Resolutions have been passed for installation of ornamental lighting systems on Second Avenue, Wind and Crescent Streets. J. R. Coonrod is city auditor.

GREEN BAY, WIS.—The Common Council is considering a new street-lighting plan whereby two ornamental standards will be installed at each intersection, replacing the present wooden pole and overhead wire equipment.

JANESVILLE, WIS.—The Parker Pen Company plans the installation of electric power equipment in a proposed six-story and basement factory addition estimated to cost $165,000. George S. Parker is president.

WEST ALLIS, WIS.—The Board of Industrial Education plans the installation of electric power equipment in a proposed three-story addition to the local vocational school at Sixty-third and Colburn Streets, estimated to cost $115,000, for which bids will soon be asked on general contract.

WITTENBURG, WIS.—The Central Wisconsin Power Company will make improvements to its power house and lines running to Birnamwood and Eland to cost $40,000.

Southern States

TEXARKANA, ARK.—The Southwestern Gas & Electric Company plans to install a white way system.

BENSON SPRINGS, FLA.—The Florida Public Service Company, Orlando, Fla., is completing work on its new generating plant on the St. Johns River and plans to begin operations at an early date. The company is said to be arranging for transmission-line extensions to a number of communities.

DELRAY, FLA.—The Florida Power & Light Company, Miami, Fla., is closing negotiations for the purchase of the local municipal electric power plant and plans extensions, including transmission-line construction.

DUNNELLON, FLA.—The City Council is planning extensions and improvements in the municipal light and power system. A bond issue is being arranged.

FORT LAUDERDALE, FLA.—The Florida Power & Light Company, West Palm Beach, Fla., has approved plans for extensions and improvements in the local substation, including the installation of additional equipment. Also, for extensions in transmission line in the vicinity of Lake City and for extensions and improvements in the system at West Palm Beach to cost about $21,000.

JACKSONVILLE, FLA. — The Duval County Board of Commissioners plan to install a lighting system along Lake City Highway, to cost $30,000.

MIAMI BEACH, FLA.—Bids will soon be asked for a new street-lighting system to be installed on Alton Road between First and Fifth Streets, First Street from Alton Road to Ocean Drive, Biscayne Avenue from Washington to Ocean Drive, the causeway approach from the viaduct to Alton Road, and Washington Avenue from Lincoln Road to Biscayne Avenue.

PALATKA, FLA.—The Florida Power & Light Company, West Palm Beach, Fla., has plans nearing completion for the construction of a power substation, outdoor type, on College Street, estimated to cost about $25,000.

WILDWOOD, FLA.—The City Council has preliminary plans under way for extensions and improvements in the street-lighting system.

AUGUSTA, GA.—The Twin City Power Company, has tentative plans under advisement for a proposed hydro-electric power development on Price's Island, Savannah River, McCormick County, N. C., for which federal permission has been secured. The station will have an initial output of 30,000 hp.

SANDERSVILLE, GA. — The Georgia Portland Cement Company, care of J. L. Hankinson, 856 Georgia Avenue, Augusta, Ga., recently organized by Mr. Hankinson and associates with capital of $3,000,000, plans the construction of a power plant at its proposed local mill. The entire plant will cost in excess of $1,000,000.

LAKE PROVIDENCE, LA.—The Mark H. Brown Lumber Company plans the installation of electric power equipment in connection with the proposed rebuilding of the portion of its mill recently destroyed by fire with loss estimated at close to $200,000.

MONROE, LA.—Plans are under consideration by the Chamber of Commerce for the installation of a white way system on Harrison Street between St. John and Sixth Streets.

SHREVEPORT, LA.—The L. H. Gilmer Company, Cottman Street, Philadelphia, Pa., plans the installation of electric power equipment at its proposed local mill, estimated to cost about $300,000. It is said that a power substation will be built for service at the plant.

AHOSKIE, N. C.—The Virginia Electric & Power Company, Richmond, Va., plans to extend line to Ahoskie and Aulander.

GUILFORD, N. C.—Work will soon be started by the North Carolina Public Service Company on the construction of a transmission line. It will be an extension from Whitsett and the Broadhurst dairy farm to Sedalia.

RICH SQUARE, N. C.—The Virginia Electric & Power Company, Richmond, Va., contemplates the installation of a power system.

SPENCER, N. C.—The Southern Railway, Washington, N. C., is planning the construction of an electrically operated pumping plant on the Yadkin River, to include the installation of two main pumping units, and a steel water tank. J. E. Todd, Charlotte, N. C., is engineer.

OKLAHOMA CITY, OKLA.—The Red Seal Refining Company, 1030 South Robinson Street, contemplates the installation of electric power equipment in a proposed refining unit, reported to cost in excess of $150,000.

BRANCHVILLE, S. C. — The Edisto Public Service Company, Denmark, S. C., is considering plans for extensions in transmission lines. The company has recently acquired the local municipal power station.

JOHNSON CITY, TENN.—The Tennessee Eastern Electric Company has applied for a preliminary permit for a power project on Nolichucky River in Greene, Unicoi and Washington Counties; three dams are proposed—at Embreeville, Buckingham Ford and one 12 miles down from the power plant on Nolichucky River.

LOOKOUT MOUNTAIN, TENN. — The City Council is said to be considering the installation of an improved lighting system on streets in the mountain district.

FORT STOCKTON, TEX.—The Texas-Louisiana Power Company will make extensions and improvements in the local municipal electric lighting plant and ice-manufacturing plant, recently acquired, to include the installation of additional equipment.

MIRANDO CITY, TEX.—The Texas Central Power Company, San Antonio, Tex., has plans under advisement for extensions in the local municipal power plant recently acquired.

Pacific and Mountain States

TOMBSTONE, ARIZ.—Plans are under consideration for the construction of an electric light plant. Bids are now being asked and in the meantime the bonds will be sold.

BAKERSFIELD, CAL.—The Santa Fe Railway Company, Los Angeles, Cal., has plans for the construction of a power plant on local site, estimated to cost $60,000, and will soon begin work.

MODESTO, CAL.—The Modesto Irrigation District has plans nearing completion for extensions and improvements in transmission lines connecting with the local substation, including new feeder circuits, estimated to cost $30,000.

ROSEVILLE, CAL.—The Enwood Sand & Gravel Company, Wells Fargo Bank Building, San Francisco, Cal., plans the installation of electric power equipment at its proposed plant near Roseville, estimated to cost about $115,000.

SAN PEDRO, CAL.—The board of directors, Turlock Irrigation District, Turlock, Cal., has approved plans for the installation of additional equipment at the plant, comprising two 7,500-kw. generating units and auxiliary equipment.

ROSEBUD, MONT.—The board of trustees, School District No. 12, has authorized the immediate construction of an electric light and power plant for school service, for which site has been selected.

BEAVER, UTAH.—The town is contemplating the installation of a new white way lighting system in the near future. The new system will extend for five blocks in the business district.

GIG HARBOR, WASH.—The city of Tacoma will award a contract in about 30 days for a substation and distribution system to cost $125,000. It will be a 2,100-kva. station, and contract will include switchboards, meters, insulators, hardware and wire.

MILLWOOD, WASH.—The Inland Empire Paper Company plans the installation of electric power equipment in a proposed addition, estimated to cost $350,000.

Canada

CROW'S NEST LAKE, ALTA.—The East Kootenay Power Company is having plans prepared for the erection of a power house to cost $1,000,000.

BONNINGTON FALLS, B. C.—The West Kootenay Power Company is planning for an increase in its power development on the Kottenay River.

FORT WILLIAMS, ONT. — The Fort Williams Paper Company plans the installation of electric power equipment in a new plant addition to cost about $250,000, for which superstructure will soon begin.

ROUYN, QUE.—The Noranda Mines & Copper Corporation, Ltd., Keefer Building, Montreal, Que., plans the installation of electric power equipment in its proposed local copper smelting plant, estimated to cost in excess of $750,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 17, 1926)

1,596,747. ARC INCANDESCENT LAMP WITH SPECIAL ELECTRODES; C. F. Lorenze, East Orange, N. J. App. filed June 28, 1923.

1,596,760. PLASTIC-COMPOSITION MATERIAL; C. A. Nash, Milwaukee, Wis. App. filed July 19, 1920. Adapted to electrical insulating purposes. Improvements in prior patent No. 1,233,416, granted July 17, 1917, to William H. Steinberg, using a composition material comprising an inert base or filler, a polymerizing or vulcanizing agent and a binder including coal-tar pitch, stearine pitch, an animal or vegetable oil capable of polymerization and a solvent of high boiling point, together with a method of combining the aforestated ingredients.

1,596,794. ELECTRIC SWITCH; A. E. Blackman, Mount Vernon, N. Y. App. filed Jan. 16, 1922. Adapted for starting motors and comprehends fused and unfused line terminals.

(Issued Aug. 24, 1926)

1,596,869. ELECTRIC HEATING ELEMENT; R. J. Claret, New York, N. Y. App. filed May 7, 1925. A device wherein an electric current is caused to pass or flow between a pair of electrodes connected normally by a suitable fluid, in which device the fluid will be heated and at a suitable or predetermined temperature in the fluid and container the pressure resulting from gas or vapor from the heated fluid will cause the same to pass below the electrodes and open their circuit, which will result in a lowering of the temperature and thereupon the condenstation of the gas will cause the liquid to restore the circuit between the electrodes and repeat the heating operation.

1,596,891. BATTERY TERMINAL WITH SELF-CLAMPING AND RELEASING MEANS; J. Rensch, Makoti, N. D. App. filed Oct. 5, 1925.

1,596,899. ELECTRIC FLASHING DEVICE; A. Sprung, Brooklyn, N. Y., and D. H. Darrin, New Rochelle, N. Y. App. filed Feb. 6, 1924. In which the periodicity of light emanations can be effectively controlled.

1,596,902. ELECTRIC FURNACE; C. E. Taylor, Penn Yan, N. Y. App. filed Nov. 20, 1920. For the production of carbon disulphide.

1,596,910. ALTERNATING-CURRENT MOTOR; H. Weichsel, St. Louis, Mo. App. filed Oct. 20, 1924. Synchronous and asynchronous motors employing a commutator and particularly applicable to large low-speed machines. Among the objects of the invention are to avoid the use of a large commutator or a large number of brushes in such machines, and also to provide means whereby the exciting magnetization may be caused to vary in the desired manner with increasing load.

1,596,964. THERMOSTAT AND METHOD OF MAKING THE SAME; J. G. Goodhue, Evanston, Ill. App. filed March 14, 1923. Thermostat in which the expansion of one fluid having a large coefficient of expansion controls the position of the conducting fluids so as to close an electrical circuit, the thermostat being so constructed as to eliminate any influence on the movement of the conducting fluid and the accuracy of the thermostat due to air or other gases contained in the thermostat. A thermostat that will respond to minute changes in temperature, and of such character as to expedite the exhaustion of air and gases from the thermostat.

1,597,030. COOLING SYSTEM FOR ELECTRICAL APPARATUS; I. W. Fisk, Morgantown, W. Va. App. filed Sept. 21, 1923. For transformers. Means for producing a forced circulation of the cooling fluid which are extremely simple in construction, may be entirely contained within the tank and do not involve the use of any external cooling medium or equipment, but which are adapted to effect a quick removal of the cooling fluid from points of maximum temperature therein and the distribution of the hot fluid to the coolest portions of the walls of the tank.

1,597,061. ELECTROTHERAPEUTIC APPLIANCE; J. A. Cultra, Omaha, Neb. App. filed Oct. 20, 1924. By which electrical current of any suitable and desired character may be applied to the body.

1,597,165. DRY CELL; M. Markiewicz and W. Romer, Warsaw, Poland. App. filed May 31, 1924. Dry cell with zinc and carbon as electrodes, depolarizer comprising manganese dioxide and thickened electrolyte comprising ammonium chloride which could be used as a secondary cell.

1,597,169. GROUND-PIPE FITTING; H. M. Taylor, Toronto, Ontario, Canada. App. filed Feb. 16, 1925.

1,597,174. OSCILLOGRAPH TIMER; J. O. Bentley, Schenectady, N. Y. App. filed March 7, 1922.

1,597,187. ELECTRIC COOKING APPARATUS; A. B. Garman, San Francisco, Cal. App. filed Nov. 30, 1925. Portable type having heat-insulated ovens and movable heat-absorbing electric heating elements.

1,597,208. ELECTRIC FURNACE FOR THE TREATMENT OF COMMINUTED MATERIAL; J. J. Naugle, Brooklyn, N. Y. App. filed April 21, 1923. Which shall permit the substantially continuous production of material of a high degree of purity.

1,597,228. COMPENSATED INDUCTION AND SYNCHRONOUS MOTOR; T. Yamamoto, Takata-Machi, Japan. App. filed March 24, 1925. A high starting resistance is connected to the secondary winding, to which also is connected an armature winding of direct-current type supplying compensating currents to the said secondary winding through a commutator, brushes and high inductances. This latter circuit should preferably be connected midway between the points where the high starting resistances are connected.

1,597,231. ELECTROLYTIC PRODUCTION OF ALKALI METALS; P. E. Haynes, Buffalo, N. Y. App. filed March 23, 1922.

1,597,232. DRY CELL; W. F. Hendry, Ossining, N. Y. App. filed July 30, 1923. Adapted to generate relatively heavy currents.

1,597,241. ELECTRIC COOKING UTENSIL; J. E. Marsden, Philadelphia, Pa. App. filed July 27, 1925. Comprising means for heating the same combined with insulating means for conserving the heat.

1,597,243. BOX-SUPPORTING EAR; C. Newman and E. G. Appleton, Chicago, Ill. App. filed Nov. 8, 1924. For switch boxes.

1,597,256. DOUBLE-RANGE VOLTMETER; E. F. Weston, Newark, N. J. App. filed Aug. 26, 1925. An attachment adapted to be connected to the back of voltmeters of known type, such attachment containing a high-range resistor and switching means for making the necessary connections to enable the voltmeter to indicate higher or lower ranges of voltages.

1,597,270. AUTOMATIC FIRE ALARM; W. A. Elliott, East Grand Forks, Minn. App. filed April 22, 1924.

1,597,296. CIRCUIT-BREAKER STRUCTURE; W. M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Aug. 30, 1921. Inclosed-type circuit breaker with mechanism of the non-closable-on-overload type.

1,597,302. LIGHTING-FIXTURE-DISPLAY SYSTEM; O. S. Wade, Valparaiso, Ind. App. filed July 31, 1924.

1,597,304. ELECTRIC TOASTER; A. A. Warner and A. F. Svensk, New Britain, Conn. App. filed Dec. 11, 1924. With a heating unit that may be independently assembled.

1,597,315. GENERATOR REGULATOR; G. E. Hulse, New Haven, Conn. App. filed May 7, 1923. For generators, particularly of the direct-current type, operated under conditions of variable speed.

1,597, 320. CIRCUIT-MAKING DEVICE; L. M. Klauber, San Diego, Cal. App. filed Aug. 5, 1922. Circuit-making device used with high-potential or high-tension circuits. A circuit-making device which will operate to prevent making the circuit until certain predetermined potential relations exist, and which will then operate certainly to make the circuit.

1,597,327. METER; J. A. Obermaier, Chicago, Ill. App. filed Nov. 25, 1922. Of the movable-coil permanent-magnet type.

1,597,356. THERMOSTAT; J. C. Gibson, Chicago, Ill. App. filed Nov. 17, 1922. Which is primarily adapted for use with a bimetallic band or a pressure-controlled element.

1,597,362. ELECTRIC STEAM BOILER; A. Hendricksson, Gothenburg, Sweden. App. filed Dec. 11, 1923. In which the heating is effected by one or more electrodes arranged in the boiler and the water serving as a resistance for the heating of the same.

1,597,388. ELECTRIC CONNECTOR IN RAIL JOINTS; C. Pascal, Montreal, Quebec, Canada. App. filed June 17, 1922.

1,597,422. HOLLOW CONDUCTOR; W. H. Bassett, Cheshire, Conn. App. filed Oct. 3, 1924. Of relatively large diameter for a given cross-sectional area of the conducting material so as to permit them to be used for high-voltage transmission without substantial corona loss or for other purposes requiring maximum diameter and surface with reduced cross-section of conducting material.

1,597,437. COMBINED PLUG RECEPTACLE AND SWITCH; F. C. De Reamer, Schenectady, N. Y. App. filed Jan. 21, 1921.

1,597,449. ALTERNATING-CURRENT MOTOR; J. G. Laubinger, Waidmannslust, Germany. App. filed Dec. 31, 1924. Induction motor which is provided with regulating or adjusting windings for supplying the motor magnetizing current.

1,597,453. ALTERNATOR; F. W. Merrill, Fort Wayne, Ind. App. filed Jan. 13, 1925. Which will directly produce an interrupted current of relatively high frequency with a relatively low frequency of interruption.

1,597,470. LIGHTING FIXTURE; W. R. Kahns, Brooklyn, N. Y. App. filed Sept. 4, 1925. Bathroom fixture.

1,597,484. INCLOSED-SWITCH ATTACHMENT; J. Sachs, Hartford, Conn. App. filed Jan. 13, 1922. The organization with the inclosing box or casing of the main service switch or controlling device of auxiliary means in the nature of an attachment or attachments to the inclosure whereby the functions of such inclosed devices can be readily expanded to serve also the uses of fused branch blocks and connect them up to the controlling device and meter, whenever it is desired to extend branch circuits from the latter.

1,597,485. REGULATION OF INDUCTION-MOTOR CASCADES; W. Seiz, Baden, Switzland. App. filed Aug. 13, 1923. The speed control of an induction motor used in connection with a regulating commutator exciter connected in cascade relation with the induction motor.

1,597,486. CONDUIT FITTING; H. A. Selah, Erie, Pa. App. filed Oct. 14, 1924. Conduit fitting which will receive unthreaded lengths of conduit and secure the same to the fittings such as boxes, couplings, and the like.

1,597,493. FREQUENCY CHANGER; W. Weller, Niederschonhausen, Germany. App. filed Nov. 7, 1924. For interconnecting alternating-current systems operated at different frequencies, and has for its object the provision of an improved arrangement for limiting the energy transmitted through a frequency changer to a safe value without interfering with the ready interchange of energy between the different systems under normal operating conditions.

1,597,552, 1,597,553. ELECTROLYTIC CELL; A. T. Stewart, Detroit, Mich. App. filed April 30, 1923. For use in the production of oxygen and hydrogen gases, which has a large surface contact with the electrolyte and a corresponding capacity for gas production.

1,597,597. STORAGE-BATTERY INDICATOR; M. L. Hoffman, East Coventry Township, Chester County, Pa. App. filed June 9, 1923. For indicating the specific gravity of the electrolyte of each cell of a storage battery by merely removing the plugs of the filling openings of the cells.

1,597,610. TESTING INSULATOR; H. E. Martz, Atlanta, Ga. App. filed April 12, 1923. For supporting telegraph or telephone wires on poles, and has for its primary object to produce a device of this character designed especially for use on long-distance open-wire conductors which permits of a lineman testing the wires to facilitate the location of trouble in the line.

1,597,614. BATTERY INDICATOR; N. S. Nelson, Pontiac, Mich. App. filed May 10, 1924. For indicating the water level of a storage battery.

1,597,630. THERMOSTATIC CIRCUIT CLOSER; C. A. Spenks, Chicago, Ill. App. filed July 23, 1924.

1,597,649. ELECTRICAL APPARATUS; E. Dickey and L. S. Keilholtz, Dayton, Ohio. App. filed Sept. 25, 1922. Farm-lighting plant.

1,597,650. ELECTRICAL APPARATUS; J. C. Federle, Dayton, Ohio. App. filed Oct. 5, 1922. Electromagnetically controlled circuit-making devices or relays which control a circuit in accordance with the amount and direction of current flow through the relay.